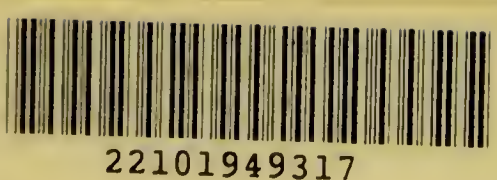
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THE PREVALENCE

C. S. Sherrington
OF
Cambridge.

ORGANIC DISEASE OF THE SPLEEN

AS A

TEST FOR DETECTING MALARIOUS LOCALITIES IN HOT CLIMATES

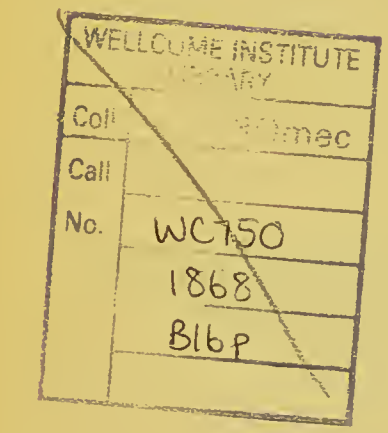
BEING

THE REPORT OF A COMMITTEE ASSEMBLED BY GENERAL ORDERS COMMANDER-IN-CHIEF, DATED THE 16TH SEPTEMBER 1854.

CALCUTTA:
OFFICE OF SUPERINTENDENT OF GOVERNMENT PRINTING.
1868.

21854

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CONTENTS.

		Page
COMMITTEE'S REPORT		1
APPENDICES.		
APPENDIX	A.	17
,,	B.	19
,,	C. Particular Account of the manner of conducting the medical examinations...	23
,,	D. Abstract shewing the comparative salubrity of seven different Military Stations in the North-Western Provinces, from 1825 to 1844...	27
,,	E. Abstract of the Medical Examinations, affording the principal data for the foregoing Report	60
,,	F. Measures connected with the execution and management of the proposed Ganges Canal, alluded to in paragraph 15 of the Report, as deserving the attention of Government	61
,,	G. Comparative Abstract shewing the Ratio of Population to area in certain irrigated and unirrigated districts of the North-Western Provinces	62
,,	H. Abstract of some of the prineipal facts recorded in the report of a Medical Committee appointed by the Government of Madras to investigate the causes of an epidemic fever which prevailed in the Provinces of Coimbatore, Dindigul, Madura and Tinnevelly, during the years 1809, 1810 and 1811.	63
,,	I. From A. KEIR, Civil Surgeon, to Major W. E. BAKER, President Canal Committee dated Ajmeer, the 18th January 1847.	65
,,	K. From N. COLLYER, Esquire, Assistant Surgeon, Mhairwara Local Battalion, to Major W. E. BAKER, President Canal Committee, dated Beawr, 4th February, 1847, ...	73

Page

NOTES ON THE APPLICATION OF THE TEST OF ORGANIC DISEASE OF THE SPLEEN, AS AN EASY AND CERTAIN METHOD OF DETECTING MALARIOUS LOCALITIES IN HOT CLIMATES. 85

LETTERS.

From T. E. DEMPSTER, ESQ., 1st Brigade Horse Artillery, to J. THORNTON, ESQ., Secretary to Government N. W. P.—Dated Loodiana the 31st January, 1848. 87

From J. THORNTON, ESQ., Secretary to Government, N. W. P. to T. E. DEMPSTER, ESQ., Surgeon, 1st Brigade, Horse Artillery, Late Member Canal Committee,—No. 972, dated Agra the 11th March, 1848. 88

APPENDIX 89

Plans Nos. 1 & 2.

Plan of Kurnal.

REPORT OF A COMMITTEE

ASSEMBLED BY

GENERAL ORDERS COMMANDER-IN-CHIEF,

DATED 16TH SEPTEMBER, 1845.

UNDER INSTRUCTIONS FROM THE

RIGHT HONORABLE THE GOVERNOR GENERAL OF INDIA IN COUNCIL.

EXTRACT FROM GENERAL ORDERS.

"Under instructions from the Right Honorable the Governor General of India in "Council, the under-mentioned Officers are directed to form themselves into a Committee to "assemble at such places and on such dates as may be fixed by the President, for the purposes "of reporting on the causes of the unhealthiness which has existed at Kurnaul, and other "portions of the country along the lane of the Delhi Canal:—the Committee will also report "whether an injurious effect on the health of the people of the Dooab is, or is not likely to be "produced by the contemplated Ganges Canal."

President:
MAJOR W. E. BAKER, *Engineers.*

Members:
SURGEON T. E. DEMPSTER, *Horse Artillery.*
LIEUTENANT H. YULE, *Engineers.*

REPORT OF A COMMITTEE

ASSEMBLED BY

GENERAL ORDERS COMMANDER-IN-CHIEF,

DATED 16TH SEPTEMBER, 1845.

UNDER INSTRUCTIONS FROM THE

RIGHT HONORABLE THE GOVERNOR GENERAL OF INDIA IN COUNCIL.

THE conduct of the investigation entrusted to our Committee, and detailed in the annexed General Order, involved the necessity of personally examining the districts irrigated by the existing canals, and such other localities as seemed best suited for a fair comparison with them. For this purpose, the Committee met at Kurnaul on the 30th November, 1845, and proceeding southward had made considerable progress in the examination of the irrigated districts west of the Jumna, when they were summoned to military duty with the army of the Sutlej. On the 1st November, 1846, the enquiry was resumed, and has continued without further interruption.

2nd. The route followed by our Committee may be traced on the accompanying sketch map. It was prescribed in some measure by the official engagements of Major Baker, whose inspection of the canals, &c., was necessarily performed in conjunction with his duties as a member of the Committee. It will be seen, that we have examined the irrigated and unirrigated districts on both banks of the Jumna, that we have visited the Nujufghur jheels, and have followed the proposed course of the Ganges canal for 83 miles, *viz.*, from Hurdwar to the latitude of Meerut. In the course of this

enquiry, we have travelled about 1,400 miles. We have visited more than 300 inhabited localities, and have personally examined upwards of 12,000 individuals of all ages.

3rd. It was suggested by our medical member, and will be generally admitted, that a fair comparison of the sanatory condition of different districts must be founded on observations taken within a very brief period of each other, and under circumstances as nearly as possible similar. The observations taken in 1845 were, therefore, useless for our present purpose, and the necessity of completing our enquiry within a period limited to about 3 months, compelled us to restrict our observations to the bodily condition of the people and to those more obvious circumstances which all modern authority concurs in pronouncing to be those most concerned in the production of disease.

4th. In the commencement of our investigation, we had hoped to derive much assistance from the results of enquiries conducted by our own native agents, and at our instance by the establishments of the Revenue and Canal departments. We have now before us an immense mass of reports obtained from such sources, but they are in general so vague and unsatisfactory, and are so little corroborated by our own personal observations, that we were unwilling to incur the labor involved in arranging and digesting them, with so little prospect of ultimately obtaining trustworthy results.

5th. Our principal object was to ascertain what relation subsisted between certain physical conditions of the different districts, and the liability of their inhabitants to miasmatic fevers. The former could be noted with some degree of certainty, but in the absence of official medical statistics, and with frequent reason to doubt the accuracy of oral testimony, although collected by ourselves, we could not obtain even an approximation to a fair comparison of the past and present sanatory condition of the inhabitants of different localities. In this difficulty, it was suggested by our medical member, that the condition of the spleen in any number of individuals would be a fair test of the probable frequency and degree in which they had suffered from malarious influ-

ences. Having satisfied ourselves of the propriety of this test, and finding it easy of application, we determined to adopt it, and have based on the results so obtained the most important of the conclusions at which we have arrived. In the Appendices B and C will be found a memoir by Mr. Dempster, stating the medical grounds for the adoption of this test, and describing the method followed in applying it.

6th. The present season, in which our observations were taken, has been a generally healthy one, and was preceded by a season scarcely less favorable. It is also separated by 8 or 9 years of good harvests from a season of drought, a circumstance decidedly in favor of unirrigating villages which have had abundant time to recover from any sickness that might have been entailed upon them by the unmitigated hardships of famine.

7th. Amongst the instructions furnished for our guidance from the Adjutant General's office, we find a series of questions, on each of which His Honor the Lieutenant-Governor, North-Western Provinces, has called for our recorded opinion. These questions embrace nearly all the important points of our investigation, the results of which cannot perhaps be shewn in a more intelligible form than that of consecutive answers to His Honor's interrogatories, as follows :—

8*th*.—First. *How far is the unhealthiness which has prevailed of late years at Kurnaul, Delhie, Hansi, Hissar and Rohtuck and in the villages irrigated from the canal attributable to the existence of the canal, and to irrigation from it?*

Reply I.—We have obtained satisfactory proof that an extensive epidemic influence, in whatever it may have consisted, or however produced, undoubtedly pervaded a large portion of the North-Western Provinces of late years, and especially during and after the rainy season of 1843. To this we would partly attribute the sickness which occurred in the canal irrigated districts, where, however, it is also certain, that the disease was generally, though not universally, more prevalent and severe than in other situations.

9*th*.—Second. *Did similar unhealthiness prevail at the same time in other parts of the country not irrigated from the canal and beyond the reach of its influence? If so, to what cause is that unhealthiness attributable? Was the type of disease in the two cases the same?*

Reply II.—Nearly all places within the North-Western Provinces also suffered from fever at the same time, and in a degree greater than usual.* We have, moreover, every reason to believe, that in certain situations neither irrigated from the canal nor within reach of its influence (as at Kythul, in the vicinity of the Nujufghur jheels, and in the khadir of the Jumna, &c.) fevers prevailed to an extent and with an intensity, as great as in the worst of the canal villages. The season of the year at which the disease appeared, its symptoms, progress, and consequences, would mark it to have been every where of the same type, *viz.*, the endemic (remittent and intermittent) of the rainy season, but every where, and especially in naturally malarious localities, greatly aggravated by the constitution or peculiarity of the season.

10*th*.—Third. *If you consider the canals to have been the cause of unhealthiness along their course, have you any grounds for thinking such to be the unavoidable result of canal irrigation, or is it attributable to other causes, such as intercepted drainage, flooding from canal, peculiarity of the soil irrigated, &c.?*

Reply III.—By far the greater part of the evils we have observed have not been the necessary and unavoidable results of canal irrigation. In all situations where mischief was prominently marked, the natural drainage of the country had been checked or interfered with, stiff and retentive soils saturated with water, and natural disadvantages of site enhanced by excess of moisture.

11*th*.—Fourth. *Can you suggest any means whereby the agricultural benefit of canal irrigation*

Reply IV.—The effects of canal irrigation appear to be remarkably local, almost strictly so: three miles would probably

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* See Appendix D.

may be continued to the country at large while Military Cantonments or large towns may be saved from the risk of unhealthiness?

be a safe distance; but if irrigation were prohibited within a circle of five miles radius round a large military station, its salubrity would not in our opinion be affected.

12*th.*—Fifth. *Can you suggest any change in the lodging or mode of life of the agricultural population within reach of canal irrigation which would render them less liable than at present to any unhealthy influence occasioned by the canals?*

Reply V.—We feel doubtful whether any suggestion proceeding from authority, as to mode of life, exposure, food, clothing and construction of houses, would be adopted and voluntarily practised by the agricultural population. The best and most efficient prophylactics of this class, naturally come with competence and ease, but much might be done to improve the salubrity of village sites, *viz.*, to stop irrigation within 200 yards round all canal villages, and to plant a double row of trees round the unirrigated space,—to deepen all good village tanks, and to keep them full of water all the year round,—to drain all shallow pools in or about villages, or to convert them into proper reservoirs of water—and wherever it may be possible, to improve the drainage of village sites. It would be no hardship on a new canal to make such works an invariable condition of obtaining water for irrigation. Cleanliness is of much though not of such vital importance as the measures above recommended; but we fear no rules on this subject could be generally enforced.

13*th.*—Sixth. *Looking to the circumstances of the eastern Jumna or Saharunpore canal, do you find that the effect of the canal irrigation on the health of the inhabitants has been the same there as on the west Jumna or Delhie canal? If not, how*

Reply VI.—The eastern Jumna canal furnishes examples of some of the best and worst results of canal irrigation. In the north and south divisions, where the soil is light, the drainage perfect, and irrigation carried on chiefly by "Rajbuhas," we perceive all the blessings and scarcely any of the evils of a canal.

do you account for this difference in effect?

But in the centre division, where the drainage of the country has been greatly obstructed, and the soil is generally more stiff and clayey, the effect on the health of the inhabitants has been the same in kind, and nearly in degree, as in the objectionable portions of the Delhie canals.

14*th.*—Seventh. *Do you suppose that the contemplated Ganges canal will or will not exercise an injurious effect on the health of the people of the Dooab, over the whole of which it is intended to extend its influence? If you are of opinion that it will, can you propose any remedy or palliatives which will not involve the entire abandonment of the undertaking?*

Reply VII.—In the course of our enquiries on the existing canals, we have found salubrity to depend in a great measure on the nature of the soil and the efficiency of the surface drainage. In the districts which it is proposed to irrigate, the obvious geographical features of the country enable us to pronounce with some confidence, that an efficient drainage, if not every where existing, is at least generally attainable. On the proposed line of the canal from Roorkhee to Meerut, we observed the soil to be light and friable ; but without an extended examination, we cannot pronounce what proportion of the remaining districts of the Dooab is characterized by similar soil. It can scarcely be hoped, however, that in the whole length of the proposed canal and its branches, some localities will not be met with, naturally and irremediably unfavourable to irrigation, and in which disease analogous to that found on the existing canals may not be expected to develope itself. On the other hand, if attention to drainage be made an absolute condition of participation in the benefits of the canal, an improvement rather than a deterioration of the general salubrity, may, in many instances, follow the introduction of canal irrigation. On the whole, we consider ourselves warranted in anticipating, on the Ganges canal, a far less amount of contingent evil than has been experienced on those of the Jumna, which were originally constructed without reference to many important points which have been especially kept in view in projecting the present work. And more

especially in drawing inferences from results on the Delhie canal, great allowances should be made for the natural disadvantages of the country through which it flows—when compared with the Dooab generally. It is a remarkable feature of the "bangur" land bordering the right bank of the Jumna, that its drainage flows from, instead of towards, that river. The slope of the country, which is to the south-west, amounts to 1 foot or 1 foot 6 inches per mile, and is not sufficient to prevent even a slight obstruction from interfering with the flow of water. In subordination to the general slope, there are minor undulations, the excess of slope in one part being compensated by the absolute want of it in another. In such cases, the drainage of the higher lands collects in the lower, and from the latter there is no efficient escape. This is exemplified on a large scale in the Nujufghur jheels, and to a less degree in many other localities. The Dooab, on the other hand, is intersected by deep depressions, sometimes with the character of valleys, sometimes of ravines. These, except in a few instances, receive and rapidly carry off the surplus water of the country.

15th. With reference to the latter part of this question, we have prepared a memorandum of measures connected with the execution of the Ganges canal, which we would strongly urge upon the attention of Government. With the details of these measures, which are of a technical nature, we have not encumbered this report, but they will be found in Appendix F.

16th. In addition to the above replies, it is proper to state our opinion of the effects produced by canals on the population of the irrigated districts, as regards their enjoyment of life and physical efficiency as agricultural laborers. During the cold season of 1846-47, (a healthy year) no obvious bad effects were perceptible in the adult population. The men generally looked healthy, happy, and thriving. The autumn crops were all gathered in, and the spring crops sown. The villagers on the western Jumna canals are better clothed and housed, and have more appearance of wealth and comfort than those off the canal. In a few of the worst localities, the aspect of the children was decidedly sickly: they were puny and pot-bellied. It must

further be borne in mind, that our observations were made at a favorable season, and that we not only refrained from calling for the sick, but systematically discouraged their being brought forward.

17th. In our examination of districts unconnected with the canals, we have included some in which well irrigation is habitually practised, and in which we have found the population in a slight degree more subject to malarious diseases than in the totally unirrigated districts. We would, however, hesitate in attributing this difference to the mere circumstance of irrigation. It may perhaps be as justly ascribed to the abundance of springs and limited depth of wells, which are essential conditions of extensive well irrigation.

18th. In endeavouring to account for the observed difference of salubrity between well and canal irrigation, we beg to point out some material differences in the circumstances under which they are severally practised. Well irrigation is chiefly resorted to during the healthy season of the year : the water obtained with labor, is used with economy, and the natural moisture of the soil is not increased by the water being transferred from a lower stratum to the surface. Canal irrigation, on the other hand, is practised throughout the year, being applied even during the rainy season to the cultivation of rice. The water being more easily obtained is more likely to be used in excess, and such portion of it as may be absorbed by the soil increases by so much its natural humidity. It may be added that foreign alluvial matter is more likely to be held in suspension in canal water, than in that obtained from wells.

19th. The pecuniary advantages of canal irrigation both to Government and to the farmer, are, we believe, fully recognized, and are so well understood by the cultivators themselves that they would willingly take their chance of the contingent evils of irrigation, in order to secure its benefits. Of this, we saw abundant proof in the course of our investigation. It would, however, have been an important test of the national value of canal irrigation, could we have accurately ascertained its effects on the density of the popu-

lation, and whether the augmented capacity of the soil for supporting life compensated for the increased activity of influences inimical to its duration. In the hope of determining this question, we obtained from the revenue authorities certain returns, of which an abstract will be found in Appendix G, and which shew a marked difference in favor of irrigated lands. It is, however, to be regretted that the census forming the basis of these returns was taken several years ago, and may therefore not be strictly applicable to the existing condition of the country.

20th. In the foregoing paragraphs, we have confined ourselves to general conclusions, fearing lest, by entering on the consideration of local details, we should extend our report to an inconvenient length. But our attention having been particularly called to the station of Kurnaul, we beg to offer a few remarks shewing briefly the causes to which we attribute the late sickness at that station, and the extent to which they may be removed or palliated.

21st. The insalubrity of Kurnaul has been ascribed to various causes :—to the prevalence of an epidemic influence, of late years, over the North-Western Provinces—to its proximity to the Jumna khadir on the east, and to the unhealthy flats of Kythul on the west—to the stiff and retentive nature of its soil—to the swamps bordering on the canal—to the extent of rice cultivation—and to the naturally imperfect drainage, being still further obstructed by the canal embankments. Each of these causes, and especially the first named, have, in our opinion, contributed to the unhealthiness of Kurnaul. Some of them are obviously irremediable, but we are satisfied of the practicability of reclaiming the canal swamps, of improving the surface drainage by carrying off the superfluous water under the canal by two tunnels to the Jumna, and of prohibiting irrigation within two miles of the Cantonment pillars. We have no doubt that the adoption of such measures would be attended with beneficial results ; but believing that the level of the springs has been permanently altered, and the under strata of the soil saturated with moisture, we cannot confidently prognosticate that they would ensure the complete restoration of salubrity.

22nd. In the foregoing paragraphs, we have confined ourselves to general conclusions, purposely omitting the chain of induction by which they have been formed on the observed facts, as recorded in the figured abstracts in the Appendix E. A full discussion of the complicated considerations which have influenced our opinions would have extended this report to an undue length, and might probably have hindered rather than facilitated the formation of a correct judgment on the important question at issue. The facts, however, are recorded for reference, and will be found, on careful examination, to support our opinions.

23rd. In conclusion, we beg to record our obligations to the Honorable the Lieutenant-Governor, North-Western Provinces, for the assistance he has afforded us, both privately and officially, in the prosecution of our enquiries. On his requisition, we have received from the Madras Government a report on a remarkable epidemic that pervaded the southern districts of that Presidency in 1809, 1810 and 1811, an abstract of which will be found in Appendix H, and at his suggestion we have obtained the appended reports from Drs. Kier and Collyer, shewing that tank irrigation, as practised in certain districts of Rajpootana, is consistent with a high degree of salubrity. These documents possess much interest with reference to the subject of our enquiry, and have had their due influence on our general conclusions.

(Sd.) W. E. BAKER, *Major, Engineers,*
President.

(Sd.) T. E. DEMPSTER, *Surgeon,*
1st Bgde. Horse Artillery,
Member of Committee.

I fully concur in the substance of this report, but as a change in my ordinary duties since I was appointed a member of this Committee has prevented my taking any active share in its proceedings, my signature here is merely formal.

(Sd.) H. YULE, *Lieutenant,*
Engineers,
Member of Committee.

APPENDICES.

APPENDIX A.

I would willingly have confined myself strictly to the facts before our Committee, did I not consider it necessary, in order that these very facts should have due weight and consideration, first, fully to meet an argument often advanced by intelligent persons interested in canal irrigation, and believed by them so unanswerable, as alone to prove the doctrine of malaria a mere fiction of medical writers, and to render all further enquiry unnecessary, viz., that some marshes can be pointed out which do not cause fevers to any extraordinary extent; and some perfectly dry localities, where fevers of a very malignant nature abound.

That certain local peculiarities are *generally* connected, as cause and effect, with certain diseases of the human body, is no hypothesis of any set of medical speculators, but a belief which has forced itself on the conviction of mankind in various ages and countries. What those conditions are which are essential to the production of endemic disease, and what are accidentally associated with them, how the poison is evolved, and what are its sensible properties and chemical composition, have indeed furnished ample grounds for medical speculation and controversy; but the general proposition itself is as fair and legitimate an induction from observed facts, as any within the whole range of science.

Exceptions do not confirm a rule, but neither do they overturn a fair induction. They only shew that our knowledge is incomplete, and the whole law of the case not fully understood. If, in the exact sciences, residual phenomena are constantly occurring; something happening which was unlooked for; something expected which does not take place; how much more may they be anticipated in such a science as medicine, where the sources of error are at once so numerous and perplexing?

Mankind, not physicians alone, have agreed, that typhus fever is a highly contagious disease. Suppose (what would not be difficult) that I collect a dozen authentic cases of persons, who have freely exposed themselves to this contagion, and who, notwithstanding, entirely escaped the disease, am I therefore to shut my eyes to the thousands of instances in which the complaint was communicated under like circumstances, and to reject the whole doctrine of contagion as untenable? Surely this would be generally condemned as a dangerous and inexcusable error! The human race have, at least, as deep a concern in the laws of malaria, as in those of contagion.

It is a remarkable and most important fact, that the diseases believed to arise from malaria, are, beyond all comparison, more prevalent during and immediately after the periodical rains in India, than at any other season of the year; and that this is precisely the time when the conditions everywhere alleged to be necessary to the production of that poison, are also, beyond all comparison, most abundant. At some places, there may be more, and at others less; in some years more, and in others less; but the truth of the general remark may be verified, in this country, at all places, and in all years.

When we remember the feeble affinities which hold together the constituents of vegetable matter, the numerous and totally dissimilar combinations into which they may enter, and the seemingly trifling accidental circumstances which may determine the nature of the new compound, it is not unreasonable to believe, that a *something* capable of causing human disease, may be evolved during the decomposition of such substances, under the action of heat, moisture, and electricity; or to conceive, that unappreciable, or at least unnoticed modifications of these conditions, or of the chemical state of neighbouring bodies, may alter the nature of the expected product, and obstruct the formation of the poison when most confidently looked for. For instance, we may make all the usual arrangements for vinous fermentation; an unexpected and unobserved change takes place in the temperature or electric condition of the atmosphere, and *vinegar* not wine is the result. Is malaria alone to be a constant and unvarying product of such complex operations, even though all the ordinary conditions are apparently present?

Again, if we admit that a certain class of fevers arise from malaria, does it necessarily follow, that all endemic fevers must originate in the same cause, or that all malaria is necessarily one and the same? Or who has demonstrated that malaria, like carbonic acid gas (an aëriform fluid, to which in some points it bears a striking analogy) may not be evolved under several and very different apparent conditions?

All our previous knowledge and experience would lead us to suspect some mischief from irrigating canals in such a climate as that of India, especially, if not expressly constructed so as to preserve the drainage of the country, and effectually to control the immoderate use of the water; and all I contend for is, that the question be tried and decided by the facts strictly bearing on the case before us, and not by a few exceptions, however striking or inexplicable, found in other distant situations or countries.

(Signed) T. E. DEMPSTER, *Surgeon*,
1st Brigade Horse Artillery,
Member of Committee.

APPENDIX B.

The first indispensable step in the present enquiry was to obtain some certain mode of determining the relative salubrity of different districts irrigated by the canals, irrigated by wells, or altogether unirrigated. In most European countries at the present day, this would have been easy enough, by the mere comparison of the known medical statistics of the several localities under examination; but in India, the difficulties were at first sight almost insurmountable. Here, we had no record of diseases, births, deaths, and population, to which we could refer. A native's account of the healthiness of his own town, or village, even for one season, is the loosest and most vague of statements, and if employed to collect positive data, his written report is not a whit more to be depended on. The aspect of the people is always a matter liable to error and difference of opinion; and the important subject of longevity cannot even be approached, for no native knows his own age correctly, least of all those advanced in years. The records of military hospitals were good and valuable data as far as they went; but they applied only to a few widely distant points, and referred to a class of subjects, differing in all important particulars from the native inhabitants of the towns or the agricultural population of the country.

In this difficulty, it occurred to me, that the inhabitants of malarious countries, but especially the native inhabitants of unhealthy districts in India, often carry in their own persons a record of past suffering, which can at all times be easily read, and which no one can either falsify or suppress. This is enlargement of the spleen, a disease to which the native of India is peculiarly liable, and which, if not the invariable consequence of miasmatic fever, is so constantly associated with it, that the one may (on the large scale) be safely taken as the measure of the other, or at least, of that malaria from which both unquestionably spring. But as this is a test which has never before (to my knowledge) been used for the same purpose, and as many of our conclusions are based on the results with which it has furnished us, I trust I shall be permitted to enter somewhat fully into the subject.

There is no fact more generally known or unhesitatingly admitted by medical men, than that disease of the spleen is one of the most frequent consequences of malarious fevers. To enumerate all the authorities on this point, would be to quote most of the respectable writers on these subjects; but that Government may appreciate the value of the test I chiefly depend on for the purpose of determining the comparative intensity of malaria in different localities, it will be proper to cite a few passages from two recent and well known works, by authors, respectively, of European and Indian experience.

"In moist countries, whether warm or temperate, they (diseases "of the spleen) are endemic, as in Italy, Holland, South America, and "some parts of India, *in fact wherever malaria exists.*"

"Tho most frequent causes of enlarged spleen are ague and re-
"mittent fover."—*Cyclopædia of Practical Medicine.*

"The most part of tho cases of vascular enlargement of the spleen
"in this country (Bengal) follow intermittent and remittent fevers,
"and tumid spleen may be stated as tho most invariable consequence
"of acute and debilitating disease among children of weak constitu-
"tions in Bengal.

"The assemblage of constitutional symptoms described in the
"foregoing pages constitutes *the endemic cachexia of those tropical*
"*countries that are subject to paludal exhalations*; the enlargement
"of the spleen is the most frequent attendant on that cachexia; and
"its increase or subsidence generally corresponds with the unfavorable
"or favorable changes which are taking place in the constitution.

"Disease of the spleen is much more frequent in those years
"in which the most obstinate, fatal, and protracted remittents
"prevail." "The history of the fevers of St. Domingo and of
"Minorca by Jackson and Cleghorn shew how frequently disease of
"the spleen is connected with the autumnal fevers of these countries.
"But great heat is not essential to the production of that disease. It
"is the autumnal endemic of Holland, of the low parts of Hungary,
"of the marshes of Lombardy; and it is by no means rare in the fens
"and marshes of England. In fact, enlargement of the spleen *is*
"*frequent wherever intermittent and remittent fevers prevail.*"—
Twining's Diseases of Bengal.

Such passages might be multiplied to a great extent, but the above will, I hope, suffice to establish the value of this kind of evidence, as a probable measure of the existence and intensity of malaria in any particular situation.

I may here remark that *Ague cake*, the name by which enlarged spleen is commonly known to the country people in the fenny districts of England, is a happy translation of *Tup tillee*,* the words used by the up-country Indian peasants to express the same disease.

Although the intimate connexion between malarious fevers, and organic disease of the spleen is established beyond a doubt, it never was supposed that these diseases bear an *exact* proportion to each other, or that the number of enlarged spleens in any particular situation, should correspond precisely with the number of attacks of fever suffered by its inhabitants. Many fevers occur, (especially if the attacks have been slight and not often repeated) without being followed by enlargement of the spleen; and many tumid or slightly inflamed spleens become natural in size and structure, soon after the fever has

* Literally, fever spleen.

passed off. On the other hand, the spleen may become enlarged from other causes, and in persons who have had no distinctly developed paroxysm of fever, although living in a malarious locality. Such cases, however, are, according to my experience, comparatively very rare.

When I first began to apply this test, I was not aware of its full value. I did not then know the extraordinary susceptibility of the natives, especially the native children of these provinces, to disease of the spleen; nor could I, before trial, have anticipated the facility with which it points out the relative salubrity of different situations, and at once detects unhealthy localities, which could not otherwise be discovered without the experience and observation of several seasons.

It must not, however, be supposed that this disease exists *everywhere* to a considerable extent, among the inhabitants of the North-Western Provinces. Places in close proximity, but in otherwise different local circumstances, exhibit the most wonderful differences in this respect; and in some extensive tracts of country, the complaint is scarcely to be met with. On the other hand, it is important to guard against exaggerated notions of the physical condition of the inhabitants of certain situations where so large a proportion are afflicted with this description of organic disease.

Enlargement of the spleen is the least formidable of all organic diseases of the viscera; and is chiefly important as a symbol of another complaint, which generally has preceded, and may come after it. The lesser varieties (marked in the figure O and S) and which also form the great mass of the cases registered, may consist with every outward *appearance* of health and vigor. In most places where the disease is common, some strikingly healthy looking men and children were found with decided enlargement of the spleen. But the larger varieties, (M.L.VL.) of which but a comparatively small number are recorded, were usually accompanied with a sickly (cachectic) aspect.

Other diseases besides fever arise from malaria, and other consequences than spleen follow severe and protracted attacks of fever; but most of these can be effectually concealed, and none can be detected with such ease and certainty as enlargement of the spleen. Indeed, without this test, our whole inquiry must have ended in vague and unsatisfactory conjecture, and without a single fact collected among the agricultural population, on which we could depend.

I have no wish to exaggerate the true and legitimate value of the spleen test, nor do I venture to assert that it will indicate the presence of the remote causes of *all fevers*, or even of all pure endemic diseases of this class. There may be different kinds of malaria, giving rise to fevers of different types, and having different complications and consequences; or common continued and typhoid fevers may become mixed

up with, and modified by, fevers of local origin. All these are worthy subjects of future inquiry. But from what I have lately witnessed, I am fully persuaded, that it will be found a true and faithful comparative measure of *marsh malaria* in its extended sense; and with *that* alone, have canals and canal irrigation any proper connexion.

It was not, however, until after we had examined the Cantonment of Meerut, that my own faith in the practical utility of the spleen test was fully established. Hitherto, spleen disease had borne some distinct relation to the nearness of water to the surface, and in a few instances where water was *very close*, we had found the almost incredible number of about 70 per cent. of the inhabitants with enlarged spleens. Was the disease then caused by moisture alone, and not always connected with marsh fevers? Meerut seemed well calculated to verify or disprove the received opinion; for in it we had a *known* healthy locality, with water only about 12 feet from the surface.

Four separate observations were made in different parts of that large station, and out of 160 native residents examined, only 3 cases of spleen were found; none above average size.

The city of Delhie appears, at first sight, an instance in which the test failed; but on careful examination, I think it will only be found to furnish a striking confirmation, of its general accuracy. The medical topography of the City, Civil Station, and Military Cantonment of Delhie, is an extremely complicated subject, and involves a great variety of important considerations, but I need only briefly notice in this place the following particulars.

Within the walls, and specially in the most dense and crowded quarters of the city, there were comparatively few indications of pure malarious disease. This accords with what has often been remarked in other countries, viz.—That the high walls, and narrow crowded smoky streets of large cities, are frequently a safe-guard against marsh miasma, although other causes of disease may abound in such situations.

In the Cantonment Bazar, and suburbs outside the walls, a considerable amount of spleen disease was found. But when we proceeded to examine the villages situated on the verge of the low moist "khadir" land, immediately in front of the old sapper lines, (a position now abandoned in consequence of its extreme insalubrity) the test at once pointed out malaria in its *highest intensity*.

(Signed) T. E. DEMPSTER, *Surgeon*,
1*st Brigade Horse Artillery*,
Member of Committee.

APPENDIX C.

Particular account of the manner of conducting the medical examinations.

It is for many reasons of great importance, that I should particularly describe the manner in which the spleen examinations have been conducted.

At each place 20 children and 20 male adults were selected, our chief care being, to take a *fair sample*, not of the sick, but of the "going about" population of the town or village under inspection. The avowedly diseased were discouraged from coming forward, and when brought were rejected, unless there were not others sufficient to make up the required number. We took subjects from all castes, and, whenever it was practicable, examined a certain number of the agricultural laborers found in the adjoining fields, before entering the village, where our numbers were completed from other classes. Each adult was asked his caste, if he had had fever this year, last year, or the year before last. The children were only questioned as to caste. Major Baker generally pointed out the subjects. I conducted the medical examination, and Major Baker entered the result in his note-book.

As the great object was to make use of an unequivocal, but easily applied test, no case was ever registered as "spleen," *unless I had so distinctly felt the enlarged organ that it could not be confounded with any other disease.* When the abdomen was natural and the muscles soft and yielding, a satisfactory examination was generally obtained in the erect position; but if the belly was rigid, and the region of the spleen tumid, but not clearly defined, the subject was put flat on his back, with the knees bent and raised. If an enlarged spleen was not discovered after a *moderately careful* examination so conducted, the person was registered as *free from the disease.* Sometimes, though rarely, really doubtful cases were met with, which could not at once be pronounced upon; these were put aside, and others examined in their stead.

It will be obvious to medical men, that if all our subjects had been examined in a variety of postures, and in various states of the stomach and bowels, several cases of spleen would have been detected, which necessarily escaped my notice. But then this test would no longer have been an *easily applied* one, besides occupying a far longer time than we could afford to bestow on each village. The disease is not only so common but in general so easily detected after a little practice, that we could afford to sink all cases not easily found, and as *precisely the same mode of examination was followed everywhere, it everywhere furnished a fair scale of comparison.*

One-half of the subjects selected for examination, was in all practicable cases composed of children under the age of puberty, 1st, because I believed young persons to be more liable to enlargement of the spleen than adults; and 2ndly, because the disease, when present, is in them more easily and certainly detected. For both these reasons, I considered children to be the more delicate test of malaria. The results amply confirm this opinion.

As the size to which the spleen attains is a very important feature of the disease, and most probably indicative of the intensity of the remote cause, I adopted a simple plan of noting 5 different degrees of size, which will be at once understood by reference to the annexed figure.

O. Signifies a distinctly marked case of spleen.
M. One decidedly larger than O, and the mean between the five varieties.
L. A large spleen extending to, or near to the navel.
VL. A very large one passing across the medial line.
S. A small but perfectly marked case of the disease.

The soft enlargements were seldom registered, even when they presented themselves. I was generally obliged to put them aside among the "doubtful cases;" for although very confident as to the real nature of the disease, a mistake was possible. But when I felt a solid tumour in the left side, distinctly ascertained its shape, consistence, and the direction of its edge, and hence knew that such could only be an enlarged spleen, in so registering it, we recorded a *fact*, not a mere medical *opinion*, resting of course on the credibility of the witness.

The very large spleen sometimes met with in bad localities, were rarely admitted into our returns, because the subjects usually presented themselves as "volunteers," and according to the rule adopted, were rejected.

(Signed) T. E. DEMPSTER, *Surgeon,*
1st Brigade Horse Artillery,
Member of Committee.

APPENDIX D.

APPEN

ABSTRACT shewing the comparative salubrity of seven different

Years.	Native Troops.											
	Loodiana.		Kurnaul.		Hansi.		Delhi.		Meerut.		Muttra.	
	Percentage of admissions.	Ditto deaths.	Ditto admissions.	Ditto deaths.	Ditto admissions.	Ditto deaths.	Ditto admissions.	Ditto deaths.	Ditto admissions.	Ditto deaths.	Ditto admissions.	Ditto deaths.
1825	0	0	0	0	0	0	0	0	25	$0\frac{1}{3}$	28	0 3-10th
1826	13	$0\frac{1}{3}$	23	0 1-5th	25	$0\frac{1}{3}$	61	0 5-6th	38	$1\frac{2}{3}$	0	0
1827	21	0 3-5th	30	$0\frac{1}{3}$	32	$0\frac{1}{2}$	55	1	49	1	33	0 6-10th
1828	24	0 1-6th	29	$0\frac{1}{3}$	45	$0\frac{1}{3}$	45	$0\frac{1}{2}$	24	0 1-5th	23	0 3-10th
1829	65	0 4-5th	48	$0\frac{2}{3}$	137	$1\frac{3}{4}$	123	$1\frac{2}{3}$	52	$0\frac{1}{2}$	0	0
1830	42	$0\frac{1}{3}$	45	0 2-5th	84	$0\frac{3}{4}$	113	1 1-5th	52	$0\frac{1}{4}$	0	0
1831	37	0 2-5th	44	0 2-5th	39	$0\frac{1}{2}$	77	0 4-5th	41	$0\frac{1}{3}$	52	0 8-10th
1832	37	0 3-5th	69	$0\frac{3}{4}$	24	0 1-10th	41	$0\frac{1}{5}$	41	$0\frac{2}{8}$	36	0 4-10th
1833	17	$0\frac{1}{2}$	46	0 2-8th	48	$1\frac{2}{3}$	62	$0\frac{2}{3}$	31	0 2-5th	32	0 9-10th
1834	46	0 1-5th	39	0 1-5th	142	$1\frac{1}{2}$	41	$0\frac{2}{4}$	27	$0\frac{1}{3}$	40	0 9-10th
1835	58	$0\frac{1}{3}$	84	$1\frac{3}{4}$	57	$0\frac{1}{4}$	72	1	55	0 4-9th	60	0 7-10th
1836	39	$0\frac{1}{2}$	55	$0\frac{2}{3}$	44	0 1-12th	61	$0\frac{1}{2}$	56	0 4-5th	46	0 7-10th
1837	46	0 3-5th	67	1	181	1 5-6th	63	$0\frac{2}{3}$	44	$0\frac{1}{2}$	23	0 4-10th
1838	55	$1\frac{1}{4}$	93	1 1-10th	162	1 1-6th	71	1	52	0 5-9th	66	3 1-10th
1839	47	$0\frac{1}{2}$	54	$0\frac{2}{3}$	160	$0\frac{1}{2}$	72	0 3-5th	49	0 3-5th	44	0 4-10th
1840	47	$0\frac{1}{2}$	43	$0\frac{2}{3}$	185	$0\frac{1}{3}$	57	0 3-7th	36	$0\frac{3}{8}$	84	0 4-10th
1841	67	1	84	$1\frac{1}{4}$	264	1 1-5th	157	1 1-9th	69	1	27	0 3-10th
1842	82	1	115	1 1-8th	119	0 4-5th	293	$1\frac{2}{3}$	149	1 1-9th	41	0
1843	91	$2\frac{3}{4}$	0	0	111	$1\frac{1}{8}$	377	3	116	1	101	3
1844	141	2 1-7th	0	0	93	1	342	$3\frac{1}{2}$	115	1 1-8th	62	0 6-10th

The above table is compiled chiefly from Returns furnished by the tion,* the few entries made under the head of that station, have been for Meerut and Delhi for the years 1842, 1843 and 1844, are stated

* Subsequently received, and the deficiencies supplied except for the year 1843, which is still incomplete.

DIX D.

Military Stations in the North-Western Provinces, from 1825 *to* 1844.

EUROPEAN TROOPS.

Agra.		Loodiana.		Kurnaul.		Meerut.		Muttra.		Agra.	
Percentage of admissions.	Ditto deaths.	Ditto admissions.	Ditto deaths.	Ditto admissions.	Ditto deaths.	Ditto Admissions.	Ditto deaths.	Ditto admissions.	Ditto deaths.	Ditto admissions.	Ditto deaths.
42	4 2-5th	0	0	0	0	107	2¼	14	0	335	2 9-10th
0	0	0	0	76	14¼	112	2⅓	0	0	0	0
31	1	0	0	148	3¾	206	3 1-5th	175	4¾	235	4 4-5th
15	0¼	0	0	140	3¼	175	3½	115	1 1-10th	228	2 7-10th
0	0	0	0	198	3⅓	152	3 1-5th	0	0	0	0
0	0	0	0	140	2⅔	145	2⅔	0	0	0	0
40	0⅓	0	0	130	2¾	118	3	161	2 9-10th	144	3
46	0⅔	0	0	136	3 2-5th	94	3½	75	0	102	1 5-9th
56	0⅘	0	0	68	2 5-6th	78	1 5-6th	82	6	112	2⅛
59	0⅔	0	0	60	3	88	2¼	86	11	109	1⅔
78	1 4-7th	0	0	64	1⅓	78	2⅔	88	0	124	1 1-9th
36	0 5-6th	0	0	130	1⅔	97	4	142	4 7-10th	126	2½
69	1¼	0	0	157	2 3-10th	75	1 3-7th	82	0 9-10th	116	4
173	5¾	0	0	201	7¼	121	4⅓	176	11½	225	7½
92	1¼	100	2 2-5th	171	5	138	2 5-7th	129	8¾	159	5⅓
125	1½	94	3⅓	152	3 2-5th	113	2¼	99	1	151	3
79	1 3-5th	109	1 4-5th	272	7¾	172	3½	146	1 1-10th	118	1 7-10th
144	1 1-10th	149	4⅓	309	9¼	346	3 3-5th	69	1	110	1 3-5th
87	1⅔	185	3⅔	0	0	293	4	124	6¾	141	5 3-5th
99	1 3-5th	189	3 1-5th	0	0	307	3 3-5th	124	1 9-10th	125	3 3-10th

Medical Board. Those for Kurnaul having been returned for correc-
extracted from a printed Table by DR. JOHN MURRAY. The Returns
to be inaccurate.

(Signed) W. E. BAKER, *Major, Engineer, President.*

(Signed) T. E. DEMPSTER, *Surgeon, Member.*

ABSTRACT of Medical Examinations of 26 *Irrigating Villages situa*

Villages.	Children of all Classes.		Adults.													
			Brahmins, Fukeers, &c.		Hindoo cultivators.		Mussulman cultivators.		Bunnias.		Artisans, &c., &c.		Menials.		Totals.	
	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E
Hansi, ...	36	24	0	0	8	0	8	4	6	4	18	6	3	3	43	17
Hissar, ...	17	23	4	0	8	2	9	0	5	1	6	4	1	0	33	7
Khurrur, ...	16	4	1	0	15	2	0	0	0	0	0	0	2	0	18	2
Raipoor, ...	10	10	0	0	13	7	0	0	0	0	0	0	0	0	13	7
Satrouda, ...	11	9	3	0	11	3	0	0	0	0	0	0	2	1	16	4
Sulems Thekopoor, ...	8	12	0	0	4	4	5	4	0	0	1	1	1	0	11	9
Shahpoor, ...	4	16	0	0	12	2	0	0	0	1	1	2	2	0	15	5
Matursham, ...	11	9	5	1	10	2	0	0	0	0	2	0	0	0	17	3
Mingnee Khera, ...	8	12	0	0	4	1	6	2	5	0	1	0	1	0	17	3
Sulemgurh, ...	10	10	2	1	4	3	2	1	1	0	0	1	3	2	12	8
Kabrere, ...	9	11	0	0	8	1	4	0	0	2	0	0	4	1	16	4
Siswal, ...	8	12	1	0	8	2	0	0	2	1	2	1	3	0	16	4
Kheree, ...	11	9	2	1	8	5	0	0	1	0	1	2	0	0	12	8
Majra, ...	5	15	2	2	2	7	1	0	0	1	1	1	2	1	8	12
Narnound, ...	12	8	0	0	12	2	0	0	4	0	0	0	0	2	16	4
Rajthul, ...	12	8	0	0	11	6	1	1	0	0	1	0	0	0	13	7
Ramra, ...	13	7	12	2	0	0	0	0	0	2	2	0	2	0	16	4
Jheend, ...	28	12	7	3	6	4	2	0	8	0	5	4	1	0	29	11
Kokhree, ...	12	8	2	0	10	4	0	0	0	0	2	0	2	0	16	4
Bohutwala, ...	8	12	1	1	9	5	0	0	1	0	0	1	0	2	11	9
Dhatrut, ...	8	12	2	0	5	2	5	0	4	0	1	1	0	0	17	3
Jamunee, ...	9	11	4	1	6	3	0	0	0	1	3	2	0	0	13	7
Rujana, ...	11	9	6	3	5	4	0	0	1	0	0	0	0	1	12	8
Suffeedhun, ...	15	5	2	1	0	0	9	2	4	0	0	1	0	1	15	5
Baroude, ...	5	8	0	0	0	0	9	5	2	0	1	0	1	2	13	7
Josshee, ...	3	17	1	2	11	3	0	0	0	1	1	0	1	0	14	6
	300	293	57	18	190	74	61	19	44	14	49	27	31	16	432	168

ted within half a mile of the Hansi branch of the Western Jumna Canals.

Percentage of adults having suffered from fever in			Percentage of enlarged spleens.	Depth of water below the surface of ground.	Annual average amount of canal irrigation.			Average annual amount of irrigated rice.	Detail of size of enlarged spleens.					
					Tor.	Daul.	Total.							
1844	1845	1846		Feet.	Beegas.	Beegas.	Beegas.	Beegas.	VL	L	M	O	S	Total.
43	33	20	34	55	5270	250	5520	700	1	4	3	21	12	41
22	22	12	37	81	580	1000	1580	0	0	3	5	17	5	30
45	20	5	15	84	940	160	1100	120	0	0	0	4	2	6
55	10	35	42	96	350	200	550	75	0	0	2	11	4	17
45	50	30	32	95	25	125	150	0	0	0	1	8	4	13
45	65	20	52	0	25	125	150	0	0	1	4	15	1	21
60	65	15	52	0	325	50	375	0	0	0	3	14	4	21
65	35	10	30	0	345	80	425	5	0	0	1	6	5	12
55	40	30	37	0	325	75	400	10	0	0	1	7	7	15
70	60	15	45	30	725	75	800	25	0	1	4	11	2	18
55	50	15	37	0	650	50	700	50	0	1	0	5	9	15
55	50	10	40	72	1130	170	1300	0	0	0	2	10	4	16
50	55	30	42	60	775	25	800	150	0	2	3	7	5	17
75	60	25	67	0	1595	25	1620	295	0	0	4	14	9	27
75	50	30	30	107	3350	50	3400	700	0	3	5	3	1	12
45	40	20	37	0	200	350	550	20	0	1	5	7	2	15
35	20	10	27	145	200	350	550	20	0	0	0	6	5	11
30	25	20	29	0	1400	500	1900	450	0	0	4	9	10	23
45	15	15	30	0	400	150	550	160	0	0	1	6	5	12
75	75	70	52	0	825	125	950	240	0	2	4	14	1	21
35	25	10	37	145	1775	125	1900	500	0	0	0	9	6	15
70	60	20	45	145	775	175	950	260	0	0	4	9	5	18
50	30	30	42	0	1075	175	1250	370	0	1	3	9	4	17
30	35	50	25	139	425	175	600	125	0	0	0	7	3	10
30	45	25	45	0	330	20	350	60	0	0	3	10	2	15
45	40	10	57	36	725	175	900	150	1	0	4	13	5	23
50	41	22	39	92										

ABSTRACT of Med. Examinations of 5 *Irrigating villages situate half a*

Villages.	Children of all Classes.		Adults.									
			Brahmins, Fukeers, &c.		Hindoo cultivators.		Mussulman cultivators.		Bunnias.		Artisans, &c.	
	N	E	N	E	N	E	N	E	N	E	N	E
Nianna, ...	18	2	2	0	11	0	1	0	1	0	1	0
Akburpore Nowlee, ...	17	3	0	0	13	2	0	0	1	1	1	0
Booreana, ...	12	8	0	0	15	2	0	0	0	0	0	1
Ameerpore Bheinee, ...	9	11	3	0	14	1	0	0	0	0	0	0
Dalimwala, ...	16	4	1	0	15	0	0	0	2	0	1	0
	72	28	6	0	68	5	1	0	4	1	3	1

mile or more from the Hansi branch of the Western Jumna Canals.

Adults.				Percentage of adults having suffered from fever in			Percentage of enlarged spleens.	Depth of water below the surface of ground.	Annual average amount of canal irrigation.			Average annual amount of irrigated rice.	Detail of sizes of enlarged spleens.					
Menials, &c.		Totals.							Tor.	Daul.	Total.							
N	E	N	E	1844	1845	1846		Feet.	Beegas.	Beegas.	Beegas.	Beegas.	VL	L	M	O	S	Total.
4	0	20	0	15	15	10	5	106	275	100	375	20	0	0	0	0	2	2
2	0	17	3	75	40	20	15	0	90	10	100	0	0	0	0	3	3	6
1	1	16	4	40	45	25	30	117	not known	not known.	not known	0	0	0	0	6	6	12
2	0	19	1	80	20	20	30	124	1480	20	1500	225	0	0	1	7	4	12
1	0	20	0	30	35	5	10	127	510	100	610	110	0	0	0	3	1	4
10	1	92	8	40	31	16	18	118										

ABSTRACT of Med. Examinations of 7 Irrigating villages distant

Villages.	Children of all Classes.		Adults.									
			Brahmins, Fukeers, &c.		Hindoo cultivators.		Mussulman cultivators.		Bunnias.		Artisans, &c.	
	N	E	N	E	N	E	N	E	N	E	N	E
Chota Oorlana, ...	11	9	0	0	0	0	14	2	0	0	2	0
Burra Oorlana, ...	11	9	2	0	1	0	14	0	1	0	0	0
Seenk, ...	17	3	0	0	13	4	0	0	1	0	0	0
Burra Anchura, ...	15	5	7	0	7	0	0	0	2	0	2	1
Gungana, ...	17	3	5	0	8	1	0	0	1	0	3	0
Bootana, ...	19	1	2	0	12	2	0	0	2	0	0	0
Barouda, ...	19	1	0	0	11	0	1	0	1	1	5	1
	109	31	16	0	52	7	29	2	8	1	12	2

half a mile or more from the Bootana branch of the W. Jumna Canals.

Adults.				Percentage of adults having suffered from fever in			Percentage of enlarged spleens.	Depth of water below the surface of ground.	Annual average amount of canal irrigation.			Average annual amount of irrigated rice.	Detail of sizes of enlarged spleens.					
Menials.		Totals.							Tor.	Daul.	Total.							
N	E	N	E	1844	1845	1846		Feet	Beegas.	Beegas.	Beegas.	Beegas.	VL	L	M	O	S.	Total.
1	1	17	3	45	40	25	30	0	475	25	500	100	0	0	0	8	4	12
2	0	20	0	45	55	40	22	106	1300	150	1450	200	0	0	2	2	5	9
0	2	14	6	50	30	20	22	109	1800	150	1950	260	0	0	0	6	3	9
1	0	19	1	50	25	20	15	138	745	5	750	20	0	0	0	5	1	6
2	0	19	1	20	15	20	10	99	2025	50	2075	80	0	0	0	4	0	4
2	0	18	2	60	60	30	7	82	3430	50	3480	500	0	0	0	3	0	3
0	0	18	2	20	30	0	7	78	4500	50	4550	20	0	0	0	1	2	3
8	3	125	15	41	36	22	16	102										

ORGANIC DISEASE OF THE SPLEEN ;

ABSTRACT of Medical Examinations of 22 Villages situated

Situation.	Villages.	Children of all Classes.		Adults.							
				Brahmins, Fukeers, &c.		Hindoo Cultivators.		Mussulman Cultivators.		Bunnias.	
		N	E	N	E	N	E	N	E	N	E
Nujufgurh Jheels.	Runhowla, ...	9	11	2	1	10	2	0	0	0	0
	Baprowla, ...	11	9	1	2	8	4	0	0	1	0
	Nujufgurh, ...	17	3	2	2	0	0	4	0	4	2
	Nugla, ...	2	18	0	2	8	5	0	0	0	0
	Pandwala, ...	4	16	2	7	3	6	0	0	0	0
	Oojwa, ...	8	12	0	1	9	2	1	2	1	0
	Shumushpoor, ...	4	16	0	0	11	7	0	0	0	0
	Isheepoor, ...	19	1	2	0	9	4	0	0	3	0
	Badlee, ...	11	9	2	0	7	0	0	0	2	1
Jumna West Khadir.	Duheerpoor, ...	3	17	0	3	7	5	0	0	0	2
	Indurput, ...	13	7	4	0	7	1	2	0	1	0
	Newul ...	8	12	0	1	0	0	7	8	0	0
	Mogul Majra, ...	7	13	1	1	6	1	3	2	0	1
Juman East Khadir.	Luknowtee, ...	10	10	1	0	1	0	2	0	2	1
	Soorajpoor, ...	7	13	0	1	2	1	9	3	0	0
	Shahdera, ...	11	9	1	1	3	1	3	1	3	1
	Joondla, ...	4	16	6	1	9	3	0	0	0	0
Valley of the Hindun.	Arthulla, ...	20	0	1	0	3	0	7	1	1	0
	Kurrara, ...	14	6	0	0	17	0	0	0	0	0
	Ghazeeoodeennuggur,	14	6	4	0	0	0	5	1	6	0
	Gokuna, ...	14	6	0	0	10	2	0	0	0	0
	Ghorao, ...	13	7	5	0	1	0	4	0	1	0
		223	217	34	23	131	44	47	18	25	8

near the Nujufgurh Jheels or in the Khadir lands of Rivers.

Adults.						Percentage of adults having suffered from fever in			Percentage of enlarged spleens.	Depth of water below surface of ground.	Detail of sizes of enlarged spleens.					
Artisans, &c.		Menials, &c.		Totals.												
N	E	N	E	N	E	1844	1845	1846		Feet.	VL	L	M	O	S	Total.
0	1	4	0	16	4	70	45	30	37	17	0	0	3	7	5	15
3	0	0	1	13	7	55	70	40	40	15	0	0	0	8	8	16
4	2	0	0	14	6	25	45	70	22	19	0	0	0	8	1	9
2	2	1	0	11	9	65	75	60	67	10	0	0	0	19	8	27
0	2	0	0	5	15	45	60	85	77	5	0	4	7	16	4	31
1	0	1	2	13	7	25	60	70	47	14	0	1	3	12	3	19
0	0	2	0	13	7	35	90	65	57	7	0	1	2	16	4	23
1	0	1	0	16	4	15	25	50	12	27	0	0	0	4	1	5
3	3	1	1	15	5	45	65	40	35	20	0	0	1	6	7	14
0	0	1	2	8	12	50	25	25	72	7	0	3	3	16	7	29
2	0	1	2	17	3	55	40	50	25	10	0	0	0	3	7	10
2	0	2	0	11	9	50	45	20	52	14	0	0	3	15	3	21
1	0	4	0	15	5	40	60	20	45	10	0	1	3	10	4	18
6	0	5	2	17	3	55	45	15	32	18	0	0	0	9	4	13
1	3	0	0	12	8	35	40	25	52	10	0	0	2	12	7	21
3	2	0	1	13	7	65	60	40	40	15	0	2	3	8	3	16
0	0	1	0	16	4	40	40	25	50	8	0	0	0	7	13	20
6	0	1	0	19	1	15	25	30	2	12	0	0	0	0	1	1
2	0	1	0	20	0	20	20	10	15	14	0	0	0	1	5	6
0	1	3	0	18	2	70	45	45	20	38	0	0	0	2	6	8
2	0	2	0	14	2	69	81	69	22	13	0	0	0	5	3	8
4	1	4	0	19	1	35	25	30	20	17	0	0	1	4	3	8
43	17	35	11	315	121	44	49	42	38	15						

ABSTRACT of Medical Examinations of 22 villages situated within

Villages.	Children of all Classes.		Adults.													
			Brahmins, Fukeers, &c. &c.		Hindoo Cultivators.		Mussulman Cultivators.		Bunnias.		Artisans, &c. &c.		Menials.		Total of adults.	
	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E
Kurnaul, ...	30	50	6	0	12	4	5	4	11	10	19	5	4	0	57	23
Phoorluk, ...	7	13	6	0	5	0	0	1	0	5	1	0	1	1	13	7
Raipoor, ...	6	14	3	1	6	2	1	0	2	0	4	1	0	0	16	4
Dhurmgurh, ...	5	15	0	4	10	2	0	0	0	0	2	2	0	0	12	8
Shera, ...	5	15	1	1	9	7	0	0	1	0	0	0	0	1	11	9
Mudlowda, ...	8	12	2	0	7	7	0	0	1	0	1	0	1	1	12	8
Kokrana, ...	11	9	0	0	5	5	0	0	1	0	2	2	3	2	11	9
Didwaree, ...	1	19	1	0	5	6	2	2	1	1	0	1	0	1	9	11
Chumrara, ...	4	16	2	1	7	4	0	1	0	1	0	1	2	1	11	9
Bullee, ...	8	12	1	2	3	2	1	0	1	2	2	0	2	4	10	10
Mahomedpoor Majra	2	18	1	2	6	4	0	0	2	1	0	2	1	1	10	10
Sitaolee, ...	5	15	0	1	6	6	0	0	2	1	2	2	0	0	10	10
Jooah, ...	3	17	3	1	5	3	0	0	0	3	1	4	0	0	9	11
Jajhee, ...	5	15	4	0	4	6	0	1	0	0	0	3	1	1	9	11
Bhutgong, ...	5	15	1	4	3	8	0	1	0	1	0	1	1	0	5	15
Jhurouth, ...	2	18	2	1	7	5	0	0	1	0	0	3	1	0	11	9
Jutowla, ...	3	17	1	5	3	6	0	0	1	1	1	1	0	1	6	14
Bowanna, ...	3	17	1	1	5	6	1	0	2	2	0	0	1	1	10	10
Hydurpoor, ...	4	16	1	2	4	5	0	0	2	1	1	1	2	1	10	10
Subzee Mundee, ...	10	10	0	0	5	1	0	0	2	2	7	3	0	0	14	6
Rohilla Khan Serai,	8	12	2	1	2	1	3	2	1	[illegible]	5	2	0	1	13	7
Delhi,*	60	20	3	0	5	0	0	0	28	3	33	3	2	3	71	9
	195	365	41	27	124	90	13	12	59	34	81	37	22	20	340	220
* Delhie City ..	47	13	1	0	5	0	0	0	22	0	25	3	2	2	55	5
Do. Cantonments ..	13	7	2	0	0	0	0	0	6	3	8	0	0	1	16	4

half a mile of the Delhi branch of the Canals West of Jumna.

Percentage of adults having suffered from fever in			Percentage of enlarged spleens.	Depth of water below the surface of ground.	Average annual amount of canal irrigation.	Average annual amount of irrigated rice.	Proportion of tor irrigation.	Proportion of daul irrigation.	Detail of sizes of enlarged spleens.					
1844	1845	1846		Feet.	Beegas.	Beegas.	Beegas.	Beegas.	VL	L	M	O	S	Total.
51	29	14	46	16	4000	1800	3600	400	1	4	12	45	11	73
55	55	45	50	14	1350	175	925	425	0	1	6	10	3	20
40	40	35	45	12	350	125	200	150	0	0	4	11	3	18
70	45	25	57	0	2200	500	1750	450	0	0	4	16	3	23
45	50	15	60	7	3000	750	2600	400	0	1	5	15	3	24
35	45	15	50	14	3130	420	2630	500	0	0	1	13	6	20
60	65	65	45	12	350	50	100	250	0	0	3	10	5	18
60	75	55	75	7	900	300	750	150	0	3	9	12	6	30
15	15	45	62	7	1450	350	1200	250	0	2	6	14	3	25
45	25	40	55	7	1710	300	1410	300	0	1	5	12	4	22
75	55	45	70	9	650	5	150	500	0	0	6	14	8	28
65	45	40	62	7	1100	50	600	500	2	3	7	10	3	25
65	40	25	70	5½	3000	400	2600	400	0	5	8	9	5	27
40	45	55	65	2½	600	150	350	250	1	3	7	13	1	25
35	60	50	75	4	5500	2500	4500	1000	1	2	5	20	2	30
65	65	50	67	5	550	20	475	75	0	0	5	15	7	27
75	25	80	77	5	1050	125	1000	50	0	3	5	18	5	31
55	40	45	67	6½	3000	800	2980	20	1	1	4	14	7	27
60	55	50	65	10	1000	225	1000	0	0	3	2	16	5	26
25	50	40	40	17	1200	10	1150	50	0	1	1	12	2	16
35	45	50	47	20	1000	175	995	5	0	1	2	10	6	19
52	32	29	18	40	—	—	—	—	0	0	3	17	9	29
51	45	41	58	11										
50	27	23	15	41					0	0	0	12	6	18
60	50	45	27	39					0	0	3	5	3	11

ABSTRACT of Medical Examinations of 28 Irrigating villages distant

Villages.	Children of all Classes.		Adults.											
			Brahmins, Fukeers, &c.		Hindoo Cultivators.		Mussulman Cultivators.		Bunnias.		Artisans, &c. &c.		Menials.	
	N	E	N	E	N	E	N	E	N	E	N	E	N	E
Sitoundi, ...	25	15	9	2	10	0	6	0	5	1	3	1	3	0
Gugseena, ...	33	7	6	0	20	1	0	0	5	0	3	0	4	1
Rair, ...	14	26	1	1	0	1	19	5	2	0	4	4	3	0
Moonuk, ...	27	13	7	0	2	1	11	1	4	3	3	1	4	3
Baul Jaton, ...	2	18	2	5	4	3	0	0	1	1	1	2	1	0
Baolee, ...	7	13	1	2	0	0	9	7	0	0	0	0	1	0
Burra Assun, ...	9	11	2	2	6	0	0	0	4	2	0	0	3	1
Chota Assun, ...	4	16	1	4	10	2	0	0	0	2	1	0	0	0
Noulta, ...	9	11	5	0	6	4	0	0	1	3	1	0	0	0
Duhur, ...	14	6	1	0	7	3	0	0	1	1	2	2	3	0
Hurtaree, ...	8	12	2	0	0	0	8	2	2	0	1	2	2	1
Brahmin majra, ...	2	18	10	5	0	0	0	0	1	0	1	2	0	1
Burra Joundhun, ...	4	16	3	5	5	5	0	0	0	0	1	1	0	0
Karud, ...	3	17	2	1	7	2	0	0	0	0	3	3	0	1
Issrana, ...	8	12	1	0	5	4	0	0	2	1	2	3	1	0
Bhinjowl, ...	11	9	6	1	6	1	1	0	1	1	0	0	3	2
Dhindar, ...	9	11	3	1	0	0	7	2	1	1	1	1	2	1
Hoolana, ...	11	9	1	2	9	3	0	0	1	1	1	1	1	0
Kurreooree, ...	0	20	2	0	6	7	0	0	0	1	0	3	0	1
Chitana, ...	5	15	1	2	10	2	0	0	1	0	1	0	2	1
Bidhlaun, ...	5	15	1	1	5	3	0	0	1	3	2	1	2	1
Suelana, ...	6	14	2	1	10	0	0	0	2	1	1	1	1	1
Sissana, ...	12	8	4	0	7	1	0	0	2	2	3	0	0	1
Kanduh, ...	9	11	2	2	7	2	0	0	0	3	3	1	0	0
Kutloopoor, ...	8	12	4	0	10	4	0	1	0	0	1	0	0	0
Burrakhera, ...	4	16	1	0	9	8	0	0	0	0	2	0	0	0
Badlee, ...	7	13	4	2	4	1	0	2	1	2	0	3	0	1
Wuzeeorpor, ...	3	17	1	1	6	6	0	0	0	1	0	3	0	2
	259	381	85	40	171	64	61	20	38	30	41	35	36	19

half a mile or more from the Delhie branch of the Canals W. of Jumna.

Totals.		Percentage of adults having suffered from fever in			Percentage of enlarged spleens.	Annual average amount of canal irrigation.			Average annual amount of irrigated rice.	Wells.	Detail of sizes of enlarged spleens.					
						Tor.	Daul.	Total.								
N	E	1844	1845	1846		Beegas.	Beegas.	Beegas.	Beegas.	Feet	VL	L	M	O	S	Total.
36	4	52	42	20	24	400	1000	1400	150	25	0	0	1	9	9	19
38	2	35	17	10	11	1680	1520	3200	200	17	0	0	0	4	5	9
29	11	47	30	5	46	2400	500	2900	900	19	1	2	7	22	5	37
31	9	52	20	17	27	2100	400	2500	950	28	0	0	2	11	9	22
9	11	50	55	40	72	1200	1000	2200	600	0	0	2	7	14	6	29
11	9	75	60	40	55	2000	300	2300	1100	10	0	3	9	7	3	22
15	5	35	25	45	40	950	150	1100	200	7	0	1	3	5	7	16
12	8	70	65	45	60	550	50	600	80	8	0	1	4	11	8	24
13	7	65	55	45	45	2900	1200	4100	100	9	1	2	3	7	5	18
14	6	30	40	40	30	850	100	950	150	33	0	0	0	8	4	12
15	5	55	55	50	42	500	50	550	40	18	0	1	0	9	7	17
12	8	45	65	55	65	950	50	1000	10	16	1	0	4	20	1	26
9	11	55	40	45	67	1000	100	1100	50	20	0	0	6	12	9	27
12	8	55	65	30	62	1115	10	1125	5	30	0	0	3	13	9	25
11	9	50	40	55	52	2030	20	2050	75	0	1	0	2	13	5	21
17	3	50	75	40	30	720	5	725	40	14	0	0	2	9	1	12
14	6	55	40	60	42	375	100	475	20	17	0	0	1	13	3	17
13	7	65	50	45	40	700	800	1500	150	15	0	0	2	5	9	16
8	12	80	70	45	80	650	50	700	50	5	1	0	11	18	2	32
15	5	30	30	55	50	680	20	700	5	12	0	0	1	12	7	20
11	9	50	40	5	60	1980	20	2000	0	15	1	1	2	17	3	24
16	4	40	50	10	45	2000	0	2000	0	33	0	0	1	13	4	18
16	4	45	40	30	30	2750	50	2800	150	40	0	0	2	7	3	12
12	8	40	40	40	47	2595	5	2600	20	18	0	1	5	12	1	19
15	5	45	55	65	42	200	50	250	0	19	1	1	1	11	3	17
12	8	80	85	75	60	2800	0	2800	400	9	0	1	4	14	5	24
9	11	30	65	65	60	1200	0	1200	200	8	0	3	2	14	5	24
7	13	60	70	45	75	1140	10	1150	175	0	0	2	3	19	6	30
432	208	51	49	40	49					18						

ABSTRACT of Medical Examinations of 9 Irrigating villages situated

Villages.	Children of all Classes.		Adults.													
			Brahmins, Fukeers, &c. &c.		Hindoo Cultivators.		Mussulman Cultivators.		Bunnias.		Artisans, &c. &c.		Menials.		Totals.	
	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E
Singpoora, ...	11	9	3	1	8	3	0	0	1	0	1	0	2	1	15	5
Chichrana, ...	9	11	1	0	9	5	0	0	1	1	2	1	0	0	13	7
Bhynswal, ...	10	10	3	0	9	0	0	0	0	1	3	2	1	1	16	4
Mahura, ...	9	11	1	0	9	4	0	0	1	1	2	0	1	1	14	6
Gohanna, ...	6	14	0	0	0	0	1	2	6	2	5	4	0	0	12	8
Muhmoodpoor, ...	7	13	0	0	11	6	0	0	1	0	0	0	2	0	14	6
Sumanka, ...	5	15	3	2	4	7	0	0	1	0	0	0	1	2	9	11
Korana, ...	12	8	5	0	9	1	0	0	0	2	2	1	0	0	16	4
Uhur, ...	9	11	4	2	7	1	0	0	0	1	2	0	2	1	15	5
	78	102	20	5	66	27	1	2	11	8	17	8	9	6	124	56

within half a mile of the Rohtuk branch of the Canals W. of the Jumna.

Percentage of adults having suffered from fever in			Percentage of enlarged spleens.	Depth of water below the surface of ground.	Annual average amount of canal irrigation.			Average annual amount of irrigated rice.	Detail of sizes of enlarged spleens.					
					Tor.	Daul.	Total.							
1844	1845	1846		Feet.	Beegas.	Beegas.	Beegas.	Beegas.	VL	L	M	O	S	Total.
50	70	45	35	52	150	0	150	0	0	0	1	7	6	14
60	40	20	45	18	1750	50	1800	50	1	0	1	8	8	18
20	15	35	35	0	1400	100	1500	150	0	1	4	3	6	14
45	40	20	42	50	1050	150	1200	125	0	0	3	8	6	17
40	30	20	55	55	1550	50	1600	300	0	1	4	11	6	22
75	40	25	47	6	3740	10	3750	425	0	0	4	8	7	19
40	35	25	65	8	1185	15	1200	125	1	2	5	11	7	26
45	25	25	30	16	4420	200	4620	700	0	0	1	9	2	12
45	50	30	40	24	2050	300	2350	250	0	0	2	9	5	16
47	38	27	44	28										

ABSTRACT of Med. Examinations of 6 Irrigating villages distant half

Villages.	Children of all Classes.		Adults.													
			Brahmins, Fukeers, &c. &c.		Hindoo Cultivators.		Mussulman Cultivators.		Bunnias.		Artisans, &c. &c.		Menials.		Total.	
	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E
Rohtuk, ...	17	3	2	0	4	0	1	0	8	0	4	0	1	0	20	0
Chumaree, ...	10	10	0	1	9	3	0	0	3	0	2	0	2	0	16	4
Sanghee, ...	11	9	2	0	14	0	0	0	2	1	1	0	0	0	19	1
Burra Guhlowr, ...	13	7	2	1	12	2	0	0	1	0	0	0	1	1	16	4
Chota Guhlowr, ...	11	9	9	7	0	0	0	0	0	0	0	0	2	2	11	9
Matún	9	11	1	0	10	3	0	0	3	0	1	0	1	1	16	4
	71	49	16	9	49	8	1	0	17	1	8	0	7	4	98	22

a mile or more from the Rohtuk branch of the Western Jumna Canals.

Percentage of adults having suffered from fever in			Percentage of enlarged spleens.	Depth of water below the surface of ground.	Annual average amount of canal irrigation.			Average annual amount of irrigated rice.	Detail of sizes of enlarged spleens.					
					Tor.	Daul.	Total.							
1844	1845	1846		Feet.	Beegas.	Beegas.	Beegas.	Beegas.	VL	L	M	O	S	Total.
5	20	40	7	72	750	0	750	0	0	0	0	0	3	3
45	65	45	35	50	650	100	750	0	0	0	0	6	8	14
65	45	15	25	28	3000	50	3050	150	0	0	2	5	3	10
35	30	25	27	46	745	5	750	20	0	0	0	4	7	11
30	25	5	45	46	500	0	500	10	0	0	1	11	6	18
25	20	30	37	47	1210	20	1230	150	0	0	5	9	1	15
34	34	27	29	48										

ABSTRACT of Medical Examinations of 24

Collectorate.	Villages.	Children of all Classes.		Adults.			
				Brahmins, Fukeers, &c.		Hindoo Cultivators.	
		N	E	N	E	N	E
Rohtuk, ...	Barouta, ...	16	4	4	3	7	1
	Gorur, ...	14	6	2	0	5	0
	Booketuh, ...	16	4	1	0	12	3
	Poolungee, ...	18	2	8	0	6	0
	Jusrana, ...	16	4	3	0	12	1
	Guewana, ...	14	6	6	0	6	0
	Kuelooee, ...	20	0	1	0	7	0
	Roorkhi, ...	17	3	2	0	4	0
	Moongan, ...	15	5	3	0	9	2
	Goyla, ...	20	0	1	0	14	0
	Doolhera, ...	19	1	2	0	10	0
	Matin, ...	19	1	2	1	9	1
	Assueenda, ...	19	1	3	0	11	2
	Khoorawar, ...	17	3	3	1	8	2
	Kheree Sadh, ...	18	2	2	1	10	0
	Ruhundana, ...	18	2	2	0	7	0
	Jowlana, ...	18	2	5	0	7	0
Hissar, ...	Burchuppur, ...	14	6	3	1	9	1
	Mohula, ...	15	5	2	0	9	1
	Bass, ...	20	0	3	0	10	1
	Bhatowl, ...	18	2	8	1	7	0
	Bugla, ...	17	3	1	0	16	0
	Jakhode, ...	18	2	1	0	9	0
	Myerr, ...	14	6	1	0	12	3
		410	70	69	8	216	18

unirrigated villages in the Delhi Territory.

Adults.										Percentage of adults having suffered from fever in			Percentage of enlarged spleens.	Depth of water below the surface of ground.	Detail of sizes of enlarged spleens.					
Mussulman Cultivators.		Bunnias.		Artisans, &c.		Menials, &c.		Totals.												
N	E	N	E	N	E	N	E	N	E	1844	1845	1846		Feet.	VL	L	M	O	S	Total.
0	0	0	0	2	1	2	0	15	5	40	40	30	22	21	0	0	1	5	3	9
0	0	3	0	8	0	2	0	20	0	20	30	15	15	60	0	0	0	4	2	6
0	0	2	0	0	1	1	0	16	4	50	30	55	20	56	0	0	1	4	3	8
0	0	1	0	1	0	4	0	20	0	45	40	40	5	82	0	0	0	1	1	2
0	0	0	1	1	1	1	0	17	3	40	30	40	17	80	0	0	0	4	3	7
2	1	1	0	1	0	3	0	19	1	40	30	30	17	90	0	0	0	3	4	7
0	0	3	0	5	0	4	0	20	0	25	15	5	0	97	0	0	0	0	0	0
0	0	5	0	7	0	1	1	19	1	20	55	40	10	93	0	0	0	3	1	4
1	0	2	0	0	1	1	1	16	4	30	20	60	22	80	0	0	0	7	2	9
0	0	1	0	2	0	2	0	20	0	10	15	30	0	45	0	0	0	0	0	0
0	0	1	0	5	0	2	0	20	0	30	5	15	2	57	0	0	0	1	0	1
0	0	1	0	4	0	2	0	18	2	35	20	25	7	65	0	0	0	1	2	3
0	0	0	0	1	0	3	0	18	2	35	30	35	7	65	0	0	1	0	2	3
0	0	2	0	2	0	2	0	17	3	60	50	35	15	77	0	0	0	2	4	6
0	0	1	0	4	0	2	0	19	1	25	20	20	7	85	0	0	0	1	2	3
4	0	0	0	6	0	1	0	20	0	40	25	5	5	122	0	0	0	0	2	2
0	0	3	0	3	0	2	0	20	0	60	35	40	5	123	0	0	0	0	2	2
0	0	1	0	2	1	2	0	17	3	30	50	40	22	132	0	0	0	6	3	9
0	0	0	0	1	1	5	1	17	3	65	55	25	20	0	0	0	0	6	2	8
0	0	2	0	2	0	1	1	18	2	50	40	35	5	132	0	0	0	0	2	2
0	0	0	0	2	0	2	0	19	1	70	60	30	7	118	0	0	0	1	2	3
0	0	0	0	2	0	1	0	20	0	80	25	10	7	81	0	0	0	3	0	3
0	0	4	0	4	0	2	0	20	0	60	15	10	5	101	0	0	0	2	0	2
0	0	1	0	1	0	1	1	16	4	70	30	15	25	102	0	0	1	6	3	10
7	1	34	1	66	6	49	5	441	39	43	32	28	11	88						

ABSTRACT of Med. Ex. of 21 *towns and villages in the Protected Sikh*

Situation.	Villages.	Children of all Classes.		Adults.					
				Brahmins, Fukeers, &c.		Hindoo Cultivators.		Mussulman Cultivators.	
		N	E	N	E	N	E	N	E
Situated near the Delhi Canal.	Dadoopoor, ...	10	9	0	0	7	2	0	0
	Boorreea, ...	13	7	4	0	2	0	1	1
	Moonda Majra, ...	14	6	3	1	5	3	0	0
	Damla, ...	10	10	1	0	9	1	3	0
	Kanjnoon, ...	6	14	1	0	8	5	0	0
	Rudowr, ...	8	12	3	0	0	0	0	0
	Zynpoor, ...	4	16	0	2	3	1	3	1
	Indree, ...	5	15	4	1	3	1	1	0
	Gooda, ...	5	15	3	2	2	1	2	3
	Khera, ...	8	12	2	2	3	3	2	0
	Beebeepoor, ...	8	12	1	1	12	2	0	0
	Dhurrur, ...	8	12	1	0	0	0	9	2
		99	140	23	9	54	19	21	7
Unconnected with the Delhi Canal.	Loodiana, ...	12	8	1	0	0	1	0	0
	Umballa, ...	19	1	0	0	4	0	5	2
	Khooda, ...	10	10	6	0	2	0	2	2
	Mullana, ...	11	9	5	2	5	0	3	0
	Mustafabad, ...	9	11	5	0	0	0	2	1
	Tejlee, ...	14	6	4	1	9	0	0	0
	Bun,...	11	9	1	1	5	1	0	0
	Ladwa, ...	12	8	1	1	1	1	1	0
	Pinjokra, ...	7	13	0	0	7	2	0	1
		105	75	23	5	33	5	13	6

States, of which 12 *are connected &* 9 *unconnected with the Delhi Canal.*

Adults.								Percentage of adults having suffered from fever in			Percentage of enlarged spleens.	Depth of water below the surface of ground.	Detail of sizes of enlarged spleens.					
Bunnias.		Artisans, &c.		Menials, &c.		Totals.												
N	E	N	E	N	E	N	E	1844	1845	1846		Feet.	VL	L	M	O	S	Total.
2	1	5	1	1	0	15	4	45	55	40	34	12	0	1	2	6	4	13
6	1	3	0	2	0	18	2	30	50	20	22	0	0	1	0	6	2	9
1	2	3	1	1	0	13	7	60	65	20	32	0	0	0	0	10	3	13
4	0	1	0	1	0	19	1	35	70	30	27	0	0	0	0	4	7	11
1	1	2	2	0	0	12	8	60	60	40	55	0	0	2	3	13	4	22
7	5	3	0	0	2	13	7	35	70	25	47	24	0	1	1	12	5	19
3	2	0	3	1	1	10	10	55	55	20	65	0	1	1	1	19	4	26
2	3	1	4	0	0	11	9	60	40	35	60	15	1	2	4	13	4	24
1	0	3	3	0	0	11	9	30	30	20	60	23	0	1	3	14	6	24
1	2	1	2	2	0	11	9	65	45	25	52	8	0	0	1	10	10	21
0	0	3	0	1	0	17	3	40	40	30	37	11	0	0	1	9	5	15
5	0	1	0	2	0	18	2	50	40	10	35	20	0	0	0	11	3	14
33	17	26	16	11	3	168	71	47	52	26	·44							
4	0	14	0	0	0	19	1	20	70	30	·22	0						
6	1	2	0	0	0	17	3	25	60	·40	10	0						
5	3	0	0	0	0	15	5	30	25	10	37	0						
3	1	1	0	0	0	17	3	65	65	30	·30	0						
8	2	1	1	0	0	16	4	55	85	25	37	0						
1	0	3	0	2	0	19	1	30	60	35	17	0	0	0	0	4	3	7
2	1	6	1	2	0	16	4	65	55	35	32	0	0	0	2	8	3	13
4	2	3	1	4	1	14	6	40	70	35	35	0	0	2	1	7	4	14
0	0	3	1	6	0	16	4	60	55	30	·42	21	0	0	2	11	4	17
33	10	33	4	14	1	149	31	43	61	30	·29							

ABSTRACT of Medical Examinations of 34 villages

Villages.	Children of all Classes.		DULT S.					
			Brahmins, Fukeers, &c.		Hindoo Cultivators.		Mussulman Cultivators.	
	N	E	N	E	N	E	N	E
Gungoh, ...	14	6	1	0	6	0	3	1
Beera Kheree, ...	16	4	2	1	12	1	1	0
Umbehta	14	6	1	0	4	0	2	0
Kheree, ...	15	5	2	0	0	0	3	0
Sidhowli, ...	17	3	0	0	17	1	0	0
Pilkhuni, ...	16	3	1	0	8	1	0	0
Jajwa, ...	11	9	3	0	5	0	3	0
Jugehta, ...	13	7	1	1	5	0	0	0
Chitowra, ...	20	0	0	0	2	0	8	0
Tajpoor, ...	20	0	7	0	5	0	3	0
Khatowli, ...	16	4	1	0	5	0	0	0
Muhmoodpoor Lahora, ...	18	2	0	0	9	0	2	0
Sutheree, ...	17	3	4	0	4	0	1	0
Sulawah, ...	19	1	2	0	8	0	1	0
Jowalagurh, ...	19	1	2	0	5	0	0	0
Sirdhana, ...	36	4	5	0	6	0	0	0
Nanoon, ...	19	1	0	0	0	0	14	1
Bhalsowna, ...	16	4	4	0	10	0	0	0
Doongur, ...	20	0	3	0	9	0	0	0
Bhola, ...	19	1	6	0	1	0	1	0
Peeplee Adureespoor, ...	19	1	5	1	8	0	3	0
Meerut Cantonment, ...	77	3	1	0	2	0	3	0
Bhoorbural, ...	18	2	6	0	8	0	0	0
Begumabad, ...	19	1	3	2	2	0	1	1
Seekree, ...	18	2	3	0	16	0	0	0
Dohaee, ...	20	0	4	0	8	0	0	0
Kurkurree, ...	20	0	3	0	14	0	0	0
Bagouth, ...	18	2	1	0	17	0	0	0
Bhyrapore, ...	19	1	7	0	12	0	0	0
Powyss, ...	15	5	4	0	15	0	0	0
Sunowli, ...	19	1	0	0	16	1	0	0
Sherpoor, ...	17	3	0	0	13	0	1	0
Solana, ...	14	6	4	0	12	0	0	0
Mokundpoor, ...	15	5	1	0	13	0	2	0
	663	96	87	5	277	4	52	3

&c., practising Well Irrigation in the Northern Dooab.

Adults.																		
Bunnias.		Artisans, &c.		Menials, &c.		Totals.		Percentage of adults having suffered from fever in			Percentage of enlarged spleens.	Depth of water from the surface of ground.	Detail of sizes of enlarged spleens.					
N	E	N	E	N	E	N	E	1844	1845	1846		Feet.	VL	L	M	O	S	Total.
1	0	4	0	4	0	19	1	70	55	40	17	16	0	0	0	2	5	7
0	0	3	0	0	0	18	2	55	55	40	15	20	0	0	0	1	5	6
7	0	4	0	2	0	20	0	60	35	10	15	11	0	0	0	4	2	6
5	1	5	1	3	0	18	2	25	45	55	17	15	0	0	0	5	2	7
0	0	2	0	0	0	19	1	25	15	5	10	14	0	0	0	1	3	4
0	0	1	0	0	0	10	1	36	45	36	13	12	0	0	0	2	2	4
5	1	3	0	0	0	19	1	65	75	35	25	14	0	0	0	3	7	10
4	0	5	0	4	0	19	1	20	30	15	20	11	0	0	0	5	3	8
2	0	7	0	1	0	20	0	30	40	10	0	30	0	0	0	0	0	0
0	0	1	0	4	0	20	0	30	10	0	0	19	0	0	0	0	0	0
10	0	3	0	1	0	20	0	60	15	10	10	20	0	0	0	1	3	4
5	0	1	0	3	0	20	0	35	25	30	5	20	0	0	0	0	2	2
3	0	7	0	1	0	20	0	55	15	20	7	22	0	0	0	0	3	3
4	0	4	1	0	0	19	1	20	25	5	5	20	0	0	0	1	1	2
4	0	8	0	1	0	20	0	40	50	30	2	25	0	0	0	0	1	1
13	0	12	0	4	0	40	0	32	35	17	5	20	0	0	0	2	2	4
3	0	0	0	1	1	18	2	35	35	35	7	17	0	0	0	2	1	3
0	0	3	0	3	0	20	0	35	30	5	10	24	0	0	0	0	4	4
1	0	4	0	3	0	20	0	25	20	20	0	35	0	0	0	0	0	0
3	0	5	0	4	0	20	0	20	25	10	2	22	0	0	0	1	0	1
0	0	1	0	2	0	19	1	25	5	10	5	25	0	0	1	1	0	2
33	0	30	0	11	0	80	0	29	29	16	2	12	0	0	0	2	1	3
0	2	1	0	2	1	17	3	35	25	30	12	19	0	0	0	2	3	5
4	0	5	0	2	0	17	3	35	30	25	10	27	0	0	0	0	4	4
0	0	0	0	1	0	20	0	0	0	0	5	29	0	0	1	0	1	2
4	0	1	0	3	0	20	0	35	40	20	0	32	0	0	0	0	0	0
1	0	0	0	2	0	20	0	30	30	10	0	35	0	0	0	0	0	0
0	0	0	0	2	0	20	0	20	20	20	5	36	0	0	0	0	2	2
0	0	0	0	1	0	20	0	35	10	25	2	38	0	0	0	0	1	1
0	0	0	0	1	0	20	0	20	10	10	12	44	0	0	0	3	2	5
0	0	1	0	2	0	19	1	35	15	10	5	35	0	0	0	0	2	2
1	0	0	0	5	0	20	0	55	30	10	7	38	0	0	0	1	2	3
0	0	0	0	3	1	19	1	45	50	10	17	36	0	0	0	1	6	7
1	1	1	0	1	0	19	1	45	50	30	15	33	0	0	0	3	3	6
114	5	122	2	77	3	729	22	37	31	20	8	24						

ABSTRACT of Medical Examinations of 20 *Unirrigated villages of which* 5 *are*

Situation.	Villages.	Children of Classes.		Adults.							
				Brahmins, Fukeers, &c.		Hindoo Cultivators.		Mussulman Cultivators.		Bunnias.	
		N	E	N	E	N	E	N	E	N	E
Ganges Khadir, ...	Kunkhul, ...	14	6	8	1	1	1	0	0	4	0
	Jowalapoor, ...	19	1	6	1	0	0	0	0	3	0
	Buhadurabad, ...	17	3	1	0	3	2	2	0	4	1
	Sautul Shah, ...	11	9	4	1	4	5	0	0	0	0
	Budheree, ..	17	3	5	0	0	0	8	2	1	0
		78	22	24	3	8	8	10	2	12	1
Bangur or high land of the Dooab, ...	Punniala, ...	15	5	4	0	8	1	1	0	1	0
	Roorkhi, ...	17	3	3	0	3	0	5	0	1	0
	Munglour, ..	30	0	4	0	2	0	8	1	5	0
	Hurriabas, ...	18	2	0	0	15	0	0	0	0	0
	Liburheree, ...	20	0	5	0	8	0	0	0	1	0
	Muhmoodpoor, ...	19	1	7	0	11	0	0	0	0	0
	Poor, ...	19	1	2	0	1	0	8	0	0	0
	Togulpoor, ...	19	1	1	0	3	0	0	0	5	0
	Khai Khera, ...	20	0	3	0	11	1	0	0	1	0
	Nirgajni, ...	20	0	1	0	16	0	0	0	0	0
	Belra, ...	20	0	2	0	4	0	0	0	8	0
	Bhopa, ...	20	0	5	0	6	0	0	0	1	0
	Yusufpoor, ...	20	0	2	0	10	0	2	0	1	0
	Jaolee, ...	20	0	3	0	1	0	10	0	1	1
	Kowal, ...	19	1	2	0	0	0	4	0	5	1
		296	14	44	0	99	2	38	1	30	2

in the N. W. Khadir of the Ganges, and 15 *are situated on the high land of the Dooab.*

Adults.						Percentage of adults having suffered from fever in			Percentage of enlarged spleens.	Depth of water from the surface of ground.	Detail of sizes of enlarged spleens.					
Artisans, &c.		Monials &c.		Totals.												
N	E	N	E	N	E	1844	1845	1846		Feet.	VL	L	M	O	S	Total.
4	0	0	1	17	3	30	35	30	22	18	0	0	1	4	4	9
8	0	2	0	19	1	35	30	30	5	56	0	0	0	0	2	2
2	0	4	1	16	4	25	40	35	17	34	0	0	1	2	4	7
1	3	1	1	10	10	60	60	20	47	9	1	0	3	9	6	19
2	0	2	0	18	2	55	45	25	12	9	0	0	0	4	1	5
17	3	9	3	80	20	41	42	28	21	25						
3	0	2	0	19	1	60	60	20	15	18	0	0	0	3	1	4
3	0	5	0	20	0	25	45	25	7	28	0	0	0	3	0	3
6	0	4	0	29	1	32	37	22	2	45	0	0	0	0	1	1
3	0	2	0	20	0	35	5	10	5	15	0	0	0	0	2	2
4	0	2	0	20	0	35	20	5	0	49	0	0	0	0	0	0
0	0	2	0	20	0	5	30	5	2	58	0	0	0	1	0	1
7	0	2	0	20	0	35	25	15	2	0	0	0	0	1	0	1
9	0	2	0	20	0	45	50	25	2	62	0	0	0	0	1	1
1	0	2	1	18	2	30	35	10	5	62	0	0	1	0	1	2
1	0	2	0	20	0	25	20	5	0	73	0	0	0	0	0	0
5	0	1	0	20	0	55	35	15	0	58	0	0	0	0	0	0
5	0	3	0	20	0	30	15	0	0	54	0	0	0	0	0	0
2	0	3	0	20	0	15	30	5	0	52	0	0	0	0	0	0
2	0	2	0	19	1	20	30	20	2	40	0	0	0	1	0	1
5	0	3	0	19	1	30	10	10	5	29	0	0	0	1	1	2
56	0	37	1	304	6	32	30	13	3	46						

ABSTRACT of Medl. Exms. of 19 *Irrigating villages situated within*

Villages.	Children of all classes.		Adults.											
			Brahmins, Fukeers, &c.		Hindoo cultivators.		Mussulman cultivators.		Bunnias.		Artisans, &c.		Menials, &c. &c.	
	N	E	N	E	N	E	N	E	N	E	N	E	N	E
Selimpoor, ...	5	15	1	2	11	6	0	0	0	0	0	0	0	0
Behtuh, ...	9	11	2	1	4	1	7	1	0	1	2	1	0	0
Sukulpoor, ...	17	3	0	0	18	1	0	0	0	0	1	0	0	0
Surrowli, ...	18	2	3	0	15	1	0	0	0	0	0	1	0	0
Duggurpoor, ...	15	5	1	1	11	0	0	0	3	0	2	0	2	0
Binnapoor, ...	20	0	0	0	11	1	1	0	0	0	4	0	3	0
Rutowl, ...	15	5	0	0	0	0	15	1	0	0	1	0	1	2
Moobarikpoor, ...	16	4	5	2	10	1	0	0	0	0	0	0	2	0
Muhrumpoor, ...	18	2	1	0	16	1	0	0	0	0	0	0	2	0
Deola, ...	13	7	2	0	4	2	5	1	2	1	1	0	2	0
Busode, ...	14	6	0	0	0	0	15	2	0	0	1	0	2	0
Nugla, ...	15	5	3	1	8	1	0	0	0	0	2	3	1	1
Ulawalpoor, ...	11	9	1	0	7	5	0	0	1	2	2	0	1	1
Barote, ...	11	9	1	1	6	2	0	0	3	0	2	1	3	1
Romalla, ...	12	8	2	3	7	2	0	1	0	0	1	0	3	1
Kukripoor, ...	12	8	1	0	12	2	0	1	0	0	1	1	1	1
Nalla, ...	10	10	4	0	11	0	0	0	1	0	2	0	1	1
Kandla, ...	13	7	1	0	8	2	4	1	2	0	1	0	1	0
Khundraoli, ...	13	7	0	1	14	2	0	0	0	0	0	1	2	0
	257	123	28	12	173	30	47	8	12	4	23	8	27	8

half a mile of the Suharunpore or E. Jumna Canal in the S. Division.

Totals. Adults.		Percentage of adults having suffered from fever in			Percentage of enlarged spleens.	Depth of water from the surface of ground.	Details of sizes of enlarged spleens.						Anunal average amount of canal irrigation.			Average annual amount of irrigated rice.
													Tor.	Daul.	Total.	
N	E	1844	1845	1846		Feet.	VL	L	M	O	S	Total.	Beegas.	Beegas.	Beegas.	Beegas.
12	8	50	50	45	57	7	0	2	1	12	8	23	47	0	47	10
15	5	40	30	30	40	19	0	0	2	10	4	16	365	19	384	26
19	1	50	35	15	10	32	0	0	0	3	1	4	216	37	253	0
18	2	50	45	25	10	24	0	0	1	0	3	4	217	284	501	4
19	1	45	40	10	15	30	0	0	1	2	3	6	342	88	430	16
19	1	65	40	5	2	32	0	0	0	0	1	1	12	25	37	0
17	3	0	0	0	20	33	0	0	0	6	2	8	633	338	971	22
17	3	40	40	0	17	33	0	0	0	4	3	7	63	504	567	23
19	1	40	60	10	7	37	0	0	0	2	1	3	103	155	258	18
16	4	70	60	20	27	24	0	0	1	5	5	11	673	844	1516	41
18	2	65	50	25	20	24	0	0	0	4	4	8	209	622	831	22
14	6	60	50	10	27	21	0	1	0	4	6	11	59	131	190	21
12	8	25	30	5	42	18	0	0	4	7	6	17	757	6	763	76
15	5	65	55	20	35	26	0	1	3	8	2	14	970	819	1789	155
13	7	50	40	25	37	21	0	0	2	5	8	15	2366	50	2416	320
15	5	45	15	5	32	27	0	0	0	5	8	13	1491	6	1497	209
19	1	45	15	10	27	21	0	0	3	5	3	11	1062	489	1551	182
17	3	30	20	15	25	23	0	0	0	4	6	10	2314	1591	3905	268
16	4	35	40	25	27	14	0	0	1	3	7	11	1898	18	2015	107
310	70	48	40	17	25	24										

ABSTRACT of Medl. Exms. of 12 *Irrigating villages more than half a mile distant*

Villages.	Children of all Classes.		Adults.											
			Brahmins, Fukeers, &c., &c.		Hindoo cultivators.		Mussulman cultivators.		Bunnias.		Artisans, &c.		Menials, &c., &c.	
	N	E	N	E	N	E	N	E	N	E	N	E	N	E
Gunowli,...	20	0	0	0	18	1	0	0	0	0	0	0	1	0
Meethlee, ...	18	2	2	0	14	1	0	0	1	0	0	0	2	0
Jounmana, ...	11	9	4	0	12	2	0	0	0	0	0	0	0	2
Dukana, ...	10	10	2	1	8	1	0	0	2	0	3	0	2	1
Loharra, ...	12	8	2	0	11	0	0	0	1	0	4	0	2	0
Bazeedpoor, ...	15	5	1	0	9	0	0	0	0	0	5	0	5	0
Bujwarra, ...	17	3	4	0	8	1	0	0	2	0	2	0	1	2
Fazilpoor, ...	12	8	2	0	12	1	0	0	0	0	3	0	2	0
Kumalla,...	18	2	3	0	12	1	0	0	1	0	0	0	3	0
Ramnuggur, ...	16	4	7	1	4	0	0	0	0	0	6	0	2	0
Tetrouda, ...	15	5	0	0	12	3	0	0	1	0	0	0	3	1
Soontee, ...	10	10	3	0	6	2	0	1	0	0	5	1	2	0
	174	66	30	2	126	13	0	1	8	0	28	1	25	6

from the Suharunpoor or Eastern Jumna Canal, in the S. Division.

Adults.																
Totals.		Percentage of adults having suffered from fever in			Percentage of enlarged spleens.	Depth of water from the surface of ground.	Detail of sizes of enlarged spleens.						Annual average amount of canal irrigation.			Average annual amount of irrigated rice.
													Tor.	Daul.	Total.	
N	E	1844	1845	1846		Feet.	VL	L	M	O	S	Total.	Beegas.	Beegas.	Beegas.	Beegas.
19	1	60	15	10	2	27	0	0	0	1	0	1	278	27	305	0
19	1	50	40	15	7	32	0	0	0	3	0	3	172	253	425	33
16	4	30	15	15	32	29	0	0	1	8	4	13	89	202	291	4
17	3	50	50	30	32	30	0	0	1	10	2	13	136	228	364	29
20	0	30	30	5	20	35	0	0	0	5	3	8	224	26	250	19
20	0	25	15	0	12	36	0	0	0	3	2	5	25	55	80	0
17	3	45	30	10	15	43	0	0	0	2	4	6	179	281	460	15
19	1	70	20	5	22	36	0	0	1	5	3	9	339	122	460	41
19	1	30	25	25	7	43	0	0	0	1	2	3	199	0	199	12
19	1	60	25	20	12	34	0	0	0	2	3	5	64	0	64	4
16	4	50	60	15	22	33	0	0	0	4	5	9	924	12	936	56
16	4	60	30	20	35	28	0	0	0	3	11	14	518	3	521	82
217	23	47	30	14	18	34										

ABSTRACT of Medical Examinations of 18 *villages, Irrigating from the*
9 villages are within half a mile of the Canal,

Situation.	Villages.	Children of all Classes.		Adults.													
				Brahmins, Fukeers, &c.		Hindoo Cultivators.		Mussulman Cultivators.		Bunnias.		Artisans, &c.		Menials, &c.		Totals.	
		N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E
Within half a mile of Canal.	Bhynswal, ...	4	16	1	2	7	4	0	0	1	2	1	0	2	0	12	8
	Khyle, ...	2	18	2	0	3	7	0	0	1	0	0	2	4	1	10	10
	Kheree Gudhai,...	3	17	1	0	8	3	0	0	1	1	1	3	1	1	12	8
	Manukpoor, ...	6	14	2	3	7	0	1	0	0	0	1	4	2	0	13	7
	Berkheree, ...	6	14	1	0	1	0	0	0	0	1	1	0	8	8	11	9
	Poojna, ..	6	14	2	0	5	4	0	0	1	1	3	1	3	0	14	6
	Munowra, ...	5	15	1	0	10	3	0	0	0	0	2	0	3	1	16	4
	Abba, ...	6	14	1	1	0	0	6	4	0	4	1	1	1	1	9	11
	Anutmhow, ...	1	19	0	0	7	7	0	0	1	0	2	1	2	0	12	8
		39	141	11	6	48	28	7	4	5	9	12	12	26	12	109	71
District more than ½ a mile from Canal.	Mundait, ...	2	18	1	0	7	7	0	0	0	0	0	0	4	1	12	8
	Mulhendee, ...	8	12	2	0	11	2	0	0	1	0	1	1	2	0	17	3
	Papuree, ..	1	19	1	0	0	0	9	7	0	0	1	0	1	1	12	8
	Teetroon, ...	8	12	2	0	7	1	1	0	2	2	3	0	0	2	15	5
	Teekrowl, ...	4	16	2	0	10	2	0	0	1	1	1	1	2	0	16	4
	Hingowli, ...	5	15	2	1	5	3	0	0	0	2	1	1	4	1	12	8
	Dhakaday, ..	8	12	1	1	9	2	2	0	0	0	1	0	4	0	17	3
	Sejour, ..	3	17	0	0	2	1	10	0	0	0	2	1	2	2	16	4
	Kunjowlee, ...	15	5	0	1	0	0	11	2	0	0	1	0	5	0	17	3
		54	126	11	3	51	18	33	9	4	5	11	4	24	7	134	46

Suharunpore or Eastern Jumna Canal, in the centre Division, of which and 9 villages are at a greater distance.

Percentage of adults having suffered from fever in			Percentage of enlarged spleens.	Depth of water below the surface of ground.	Detail of sizes of enlarged spleens.						Annual average amount of canal irrigation.			Annual average amount of irrigated rice.
											Tor.	Daul.	Total.	
1844	1845	1846		Feet.	VL	L	M	O	S	Totals.	Beegas.	Beegas.	Beegas.	Beegas.
40	35	30	60	7	0	0	2	12	10	24	2108	289	2397	542
60	45	40	70	6	0	2	4	18	4	28	779	58	836	249
85	65	15	62	3	0	0	2	15	8	25	485	3	488	143
75	65	35	52	8	0	0	1	12	8	21	371	87	458	130
50	65	40	57	8	0	1	5	7	10	23	230	65	294	143
50	45	15	50	9	0	0	2	8	10	20	242	57	299	74
70	50	30	47	9	0	0	0	9	10	19	370	23	393	104
50	40	5	62	11	0	2	5	10	8	25	455	32	487	159
90	80	65	68	7	0	0	5	14	8	27	491	116	607	208
63	54	31	59	8										
35	35	25	65	20	0	0	6	16	4	26	503	145	648	121
50	40	25	37	14	0	1	3	5	6	15	38	17	55	0
55	65	35	67	11	0	0	5	12	10	27	592	20	613	252
75	45	25	42	16	0	0	3	4	10	17	600	13	613	45
85	60	30	50	11	0	1	3	8	8	20	1530	80	1610	523
60	55	35	57	17	0	0	1	10	12	23	329	55	384	0
55	55	20	37	18	0	0	0	5	10	15	117	0	117	78
50	65	50	52	11	0	0	1	11	9	21	496	143	639	201
70	60	35	20	12	0	0	0	3	5	8	160	108	268	78
60	53	33	47	14										

ABSTRACT of Medl. Exms. of 15 villages, &c., under various circum-

Circumstances.	Villages.	Children of all Classes.		Adults. Brahmins, Fukeers, &c.		Hindoo cultivators.		Mussulman cultivators.		Bunnias.		Artisans, &c., &c.	
		N	E	N	E	N	E	N	E	N	E	N	E
Irrigating within half a mile of Canal.	Reeree, ...	7	13	3	0	8	3	0	0	1	0	3	0
	Rutnakhera, ...	13	7	0	1	5	2	0	0	0	0	7	1
	Manickmhow, ...	12	8	4	0	5	1	0	0	1	0	3	2
	Rundole, ...	17	3	1	0	4	1	0	0	2	0	8	1
	Kulsea, ...	19	1	3	0	8	0	0	0	3	0	0	0
	Raipoor, ...	19	1	5	0	4	0	2	0	1	0	5	0
		87	33	16	1	34	7	2	0	8	0	26	4
Irrigating distant more than half a mile from Canal.	Nowabas, ...	11	9	0	0	13	1	0	0	1	1	2	0
	Hurpal, ...	12	8	0	0	0	0	5	1	5	1	6	0
	Suhujwa, ...	17	3	4	0	10	0	0	0	1	0	0	0
	Beetia, ...	15	5	2	1	7	2	0	0	0	1	4	0
	Suharunpore, ...	31	29	4	1	7	6	5	2	8	1	13	4
	Behut, ...	18	2	0	0	2	1	7	0	4	1	3	0
		104	56	10	2	39	10	17	3	19	5	28	4
Unirrigated near head of Canal.	Nyashuhur, ...	19	1	1	0	6	0	1	0	0	0	8	0
	Tanda, ...	20	0	0	0	6	0	0	0	0	0	3	0
	Fyzabad, ...	15	5	2	0	6	0	0	0	2	0	3	1
		54	6	3	0	18	0	1	0	2	0	14	1

stances in the Northern Dn. of the Suharunpore or Eastern Jumna Canal.

Adults.																		
Menials, &c, &c.		Totals.		Percentage of adults having suffered from fever in			Percentage of enlarged spleens.	Depth of water from surface of ground.	Detail of sizes of enlarged spleens.					Annual average amount of canal irrigation.			Average annual amount of Irrigated Rice.
														Tor.	Daul.	Total.	
N	E	N	E	1844	1845	1846		Feet.	VL	L	M	O	S	Total.	Beegas.	Beegas.	Beegas.	Beegas.
2	0	17	3	55	65	25	40	3	0	0	1	6	9	16	436	72	508	56
3	1	15	5	40	55	25	30	9	0	0	0	5	7	12	82	10	92	15
3	1	16	4	25	35	5	30	12	0	0	0	6	6	12	403	123	526	148
3	0	18	2	10	50	55	12	7	0	0	1	2	2	5	643	86	729	413
5	1	19	1	10	15	10	5	8	0	0	0	1	1	2	0	0	0	0
3	0	20	0	20	15	45	2	0	0	0	0	1	0	1	52	3	55	0
19	3	105	15	27	39	27	20	8										
2	0	18	2	55	40	40	27	9	0	0	0	3	8	11	272	180	452	117
2	0	18	2	40	70	30	25	16	0	0	1	4	5	10	41	18	59	6
4	1	19	1	10	25	10	10	11	0	0	0	0	4	4	99	183	282	14
3	0	16	4	60	60	20	22	18	0	0	0	3	6	9	3	0	3	0
7	2	44	16	33	45	40	38	8	0	3	5	20	17	45	0	0	0	0
2	0	18	2	25	40	40	10	18	0	0	0	1	3	4	41	4	45	0
20	3	133	27	37	47	30	22	13										
4	0	20	0	25	30	10	2	0	0	0	0	0	1	1	0	0	0	0
11	0	20	0	35	40	30	0	0	0	0	0	0	0	0	0	0	0	0
6	0	19	1	45	60	40	15	0	0	0	0	3	3	6	0	0	0	0
21	0	59	1	35	43	27	6											

Irrigated from the Western Jumna Canals.	Delhi Branch,	...	..	...
	Rohtuk Branch,	...	...	..
	Bootana Branch,	...	...	...
	Hansi Branch,	...	...	...
Irrigated from the Eastern Jumna Canals.	Northern Division,	...	...	..
	Centre Division,	...	...	...
	Southern Division,	...	...	...
Irrigated from wells in the high land of the Dooab,		...	...	...
Unirrigated.	Sikh States,	...	...	...
	Delhi Territory,	...	...	...
	Northern Doab,	...	...	...
	Naturally malarious localities,	...	...	...

of Medical Examinations.

	Percentage of enlarged spleens.	Percentage of adults having suffered from fever in			Average depth of water from surface of ground.
	Adults and Children of all Classes.	1844	1845	1846	Feet.
Within half a mile of the Canal, ...	58	51	45	41	11
Distant more than half a mile, ..	49	51	49	40	18
Within half a mile of the Canal, ...	44	47	38	27	28
Distant more than half a mile, ...	29	34	34	27	48
Distant more than half a mile, ...	16	41	36	22	102
Within half a mile of the Canal, ...	39	50	41	22	92
Distant more than half a mile, ...	18	40	31	16	118
Within half a mile of the Canal, ...	20	27	39	27	8
Distant more than half a mile, ..	22	37	47	30	13
Within half a mile of the Canal, ...	59	63	54	31	8
Distant more than half a mile, ...	47	60	53	33	14
Within half a mile of the Canal, ...	25	48	40	17	24
Distant more than half a mile, ...	18	47	30	14	34
... ...	8	37	31	20	24
Connected with the Canal, ...	44	47	52	26	0
Unconnected with the Canal, ...	29	43	61	30	0
Unconnected with the Canal, ...	11	32	28	11	88
High or Bangor land, ...	3	32	30	13	46
Ganges Khadir, ...	21	41	42	28	25
Near head of Eastern Jumna Canal,...	6	35	43	27	0
Nujufgurh Jheels, ...	44	42	59	57	15
Valleys of Jumna and Hindun, ...	34	46	42	31	14

APPENDIX E.

Abstract of the Medical Examinations, affording the principal data for the foregoing Report.

The recorded numbers of natural and enlarged spleens may be received as representing authentic facts.

The percentage of sufferers from fever in the several years is deduced from the records of oral testimony collected by the Committee, and may possibly in many instances be not strictly correct. It is hoped however that in the general averages will be found an approximation to the truth, and the means of comparing with tolerable certainty the salubrity of different years.

The depths of water from the surface of ground were ascertained by actual measurement and the information regarding the extent and nature of Canal irrigation was furnished by the Superintendents of the respective Canals.

Explanation of the headings used in the subjoined Abstracts.

N. Natural or healthy spleens.
E. Enlarged spleens.
VL. L. &c. Sizes of spleens as in Appendix C.
Tor irrigation is where the water flows naturally over the soil as distinguished from

Daul irrigation, where the water is artificially raised to the level of the ground.

The areas of irrigated land are stated in beegas of 3,025 square yards, 640 beegas beingequal to 1 square mile.

APPENDIX F.

Measures connected with the execution and management of the proposed Ganges Canal, alluded to in paragraph 15 *of the Report, as deserving the attention of Government.*

The Committee would recommend as follows :—

1st. That the Ganges Canal be kept as much as possible within soil, i. e., that its ordinary surface level should be below that of the country.

2nd. That earth wanted to complete embankments, be never obtained from excavations made outside of the canal, except in such localities as will readily admit of drainage.

3rd. That the canal and its branches be taken as much as possible along the water-shed line of the country, so as not to interfere with drainage, and in all cases where such interference may be unavoidable, that the executive office be instructed to provide otherwise for the drainage.

4th. That masonry drains be constructed under Rajbuhas or Bridge Ramps, whenever these cross the drainage of the country.

5th. That no private water-courses be allowed, but that irrigation be practised exclusively from Rajbuhas or main water-courses.

6th. That irrigation be prohibited within five miles of a military station and within one or two miles of large native towns.

7th. That in clearing embankments, the grass, weeds, &c., be not suffered to rot on the ground, but that they be burned as soon as possible after they are cut.

8th. That irrigation be altogether prohibited in localities which appear naturally to possess a malarious character.

The Committee are aware that the adoption of the measures above recommended would involve an expense not contemplated in the original estimates for the Ganges Canal.

(Signed) W. E. BAKER, Major, *Engineer and President.*

(Signed) T. E. DEMPSTER, Surgeon, *Member.*

APPENDIX G.

Comparative Abstract shewing the Ratio of Population to area in certain irrigated and unirrigated districts of the North-Western Provinces.

Detail of irrigation, &c.	Name of Collectorate.	Number of Villages.	Aggregate area in Beegas of 3025 square yards.	Aggregate Population.	Population per square mile.	Average Population per square mile.
Irrigated from Canals.	Paniput, ...	96	329,947	74,360	231	
	Delhie, ...	49	101,472	33,754	341	
	Rohtuk, ...	52	221,262	60,007	278	317
	Hissar, ...	35	224,563	11,485	54	
	Mozuffernuggur, ...	15	23,195	15,406	680	
Irrigated from Wells.	Mozuffernuggur, ...	100	118,856	57,665	497	0
Unirrigated.	Paniput, ...	29	61,194	12,320	206	
	Rohtuk, ...	61	373,531	59,895	164	
	Hissar, ...	40	323,207	16,014	51	165
	Mozuffernuggur, ...	73	95,416	22,189	238	

This Abstract is referred to in paragraph 19 of the Report.

(Signed) W. E. BAKER, MAJOR,
President.

(Signed) T. E. DEMPSTER, SURGEON,
Member.

APPENDIX H.

Abstract of some of the principal facts recorded in the report of a Medical Committee appointed by the Government of Madras to investigate the causes of an epidemic fever which prevailed in the Provinces of Coimbatore, Dindigul, Madura and Tinnevelly, during the years 1809, 1810 *and* 1811.

The soil of Coimbatore is in general dry, but there is no want of extensive tanks. In the vicinity of the Hills is much low marshy ground, and many villages in such situations are proverbially unhealthy. On the whole the Coimbatore country may be called healthy in common years.

Dindigul is a mountainous and woody country, encompassed by high lands, and more or less covered by Jungle of prodigious height. Climate stated to be proverbially healthy in common years.

Madura is a more open and less mountainous country than Dindigul; it is hotter in the hot season and not quite so cold in the months of December and January. The climate of this district, in common seasons, cannot by any means be considered unhealthy, although the fort has been so for several years, and before the epidemic prevailed. Like most mountainous countries in the torrid zone, Madura has situations where fever never fails, at certain seasons, to be endemic; but the disease does not generally spread beyond these localities. There are some villages close to, and amongst the Hills, lying in the most western parts of the province, in which, in the months of March and April, no man can pass a single night without suffering an attack of fever soon after. Both the houses and clothing of the inhabitants are of a very inferior description.

Tinnevelly is considerably lower than any of the other provinces in which the epidemic prevailed; it may, in the strictest sense, be called an open country; as few Hills are to be found in it, and those are isolated or detached. It contains several waste and jungly tracts, especially towards the east. There are also, here and there, extensive low and marshy lands in the vicinity of the mountains, &c. Situations at a certain distance from the Hills, are higher and drier than those which are nearer to them. Culpettie, standing in a fine elevated country, was comparatively comfortable and healthy, whilst Tewancootshie, due west from the former and close to high land, was found nearly surrounded with wet ground, damp, ruinous and almost depopulated. Towards the southern and eastern extremity of the peninsula, there are many salt marshes, formerly distinct from each other, but four

of them now (date of report) joined together, owing to recent inundations. They are separated from the sea by high sand hills, and have no natural communication with it. In common years there is not much water collected in them, but since the heavy monsoon of 1810, and especially since the rains which fell in February and March, out of all season, they have been filled to a depth of 5, 7 or 10 feet, and the water by remaining long in a state of stagnation has been productive of infinite mischief. In December 1810, the inhabitants of villages near these salt swamps (10 or 12 in number), complained that their houses were rendered uninhabitable, their lands flooded, and that water had risen so high on their Palmyra trees that they were unable to draw the "Toddy." The valley of Courtallum, however delightful its climate in June, July, August and September, is far otherwise in February, March, April and May; it partakes of both monsoons, and from its singular topographical position is, in a great measure, deprived of the salutary influence of the southerly winds. At the last-mentioned period, it is close, hot and sultry in the greatest degree, and never fails to be most unhealthy. Endemic fever, at such times, is as certainly met with here, as at Gambia or Senegal. On the whole the epidemic fever has raged with the greatest violence in Tinnevelly.

General Causes—Believed to be unusual and irregular seasons. Several remarkably dry seasons (themselves healthy), followed by seasons in which an unusual quantity of rain fell, prevailing winds blew with less regularity. Many cattle died, as much from an unnatural state of the atmosphere, as from a want of hands to feed and take care of them.

Progress.—The epidemic was first noticed in certain places close to the Hills, marshy and proverbially unhealthy; and afterwards spread over tracts naturally drier and more healthy. Certain parts of the Madura Collectorate near the sea or rather further removed from the range of mountains, escaped the disease altogether; with the exception of the inhabitants in the vicinity of a salt marsh. Tinnevelly appears to have been last in suffering from the epidemic. The fever invariably proved most destructive in those villages nearest the Hills, in villages standing low or in the vicinity of marshy lands, and among the poor ill-fed and badly-lodged population.

The disease which proved so fatal in the southern provinces, does not differ from the common endemic of the country, which, at certain seasons, and in particular situations, may be every year met with. Its having been rendered epidemic on the present occasion, is altogether to be ascribed to the causes already mentioned.

(Signed) W. E. BAKER, Major,
President.

(Signed) T. E. DEMPSTER, Surgeon,
Member.

APPENDIX I.

To Major W. E. Baker, *President Canal Committee, from* A. Keir, *Civil Surgeon, dated Ajmeer, the* 18*th January* 1847.

Sir,—I have the honor, in reply to your letter No. 886 of 1846-47, under date the 11th December last, to submit the following observations, as the result of the enquiries I have made regarding the effect of irrigation practised in this district upon the health of the cultivators.

A.

In the first place, relative to the expression made use of in your communication, "extensive irrigation," I would beg to remark, that it seems applicable rather to denote the condition of the district *as it now is*, with reference to its former unimproved state before coming under Major Dixon's management, than the actual amount of *irrigated* as compared with *unirrigated* land to be found within its limits.

External feature of the country.

Characteristic of this part of the country generally, and of the Ajmeer district in particular, are the numerous ranges of rocky hill which give a bold and rugged aspect to the scenery, but which tend in no less degree to modify the soil and its productions. From these hills come down numerous small streams, the channels of which remain dry during a great part of the year, but speedily fill after a heavy fall of rain. It is by taking advantage of the water thus poured upon the ground, by making embankments, and so laying it under contribution, that some degree of fertility is imparted to a district otherwise of a highly unpromising and unfruitful description. Wonderful indeed and pleasing is the change which has been effected by such means. The waste has been subdued in many places, and instead of a bare, barren-looking surface, producing only a few thorny shrubs, there is now to be seen a smiling sheet of cultivation; and this extending year by year as the skill and industry of the people can be brought to bear on the work of improvement.

Geological character of the hills.

The hills of this district of country belong to the primitive formation. They consist principally of granite rock, (granite and gneiss) quartz-mica and hornblende schist; crystaline limestone is found in the vallies, but the crystals large and the stone of a coarse description. The materials composing the rocky masses are aggregated in every variety of way and proportion, and hence occurs a great diversity in the color, aspect and consistence of the different rocks.

Inclination of the strata.

The general structure of the rocks is schistose, and the strata for the most part have a very high inclination. The dip varies exceedingly. Hereabouts it seems to be more often from west to east; but in other parts the opposite direction prevails. There can be no particular rule laid down in this respect, as regards the lakes or reservoirs for irrigation. These are found on one side of the hill as well as the other, and in the vallies between different ranges. Without minute investigation, the direction of the strata may generally be judged of by the appearance of the hill, the steep abrupt face showing the broken termination of the strata; the opposite more inclined face indicating their direction upwards. In many places, the strata seem perpendicular to the surface, or very nearly so.

Soil.

The soil of the district is composed of the "debris" of these different rocks. It is in a large part silicious; but mica abounds in it and also felspar. The latter ingredient, washed down by the nullahs, exists abundantly in the beds of talaos or tanks, and there gives a clayey consistence to the soil. A "light reddish loam" may perhaps be the appellation most generally applicable to designate the character of the soil. Tried with acids it effervesces tolerably freely. A correct analysis, however, I am not prepared to offer. Calcareous earth is very abundant in some situations, particularly so along the margins of nullahs, where it exists in the form of "kunkur," mixed with other gravelly matter. The proportion of material of vegetable origin is not in general great. Hence the practice of "manuring" is one diligently followed, and the crop in general rises in proportion. Indeed, without "manuring" there is little to be got from a soil so naturally poor. An exception is to be found in this respect in the beds of "talaos," where, from the washings of the stream, there is a rich alluvial deposit, and where, in consequence, excellent crops are raised independent of manure. The ground so favorably situated, however, forms but a small space. The salts which seem most to abound in the soil are those of soda, the muriate and carbonate in particular. In some parts the effervescence on the surface is very abundant, and this has sometimes an alkaline and sometimes a strongly saltish taste. Dr. Irvine remarks that the quantity of potash in the soil, comparatively with the quantity of decomposing felspar and mica, is small.

Soil, its qualities.

But not only is the soil poor as respects the proportion of fertilizing ingredients, it is likewise, over a considerable part of the district, deficient as to quantity. The nearness of the rock to the surface may in general be guessed at from its coming into view every here and there. In some places there appear round or tabular masses of rock; in others sharp spinous looking ridges. These latter are generally of

quartz, and indicate the direction of "dykes or veins," the material from its hardness having withstood the action which has disintegrated and decomposed the softer rocky masses around.

Country adapted for tanks.

Happily, a country of this description is well adapted to illustrate what may be done for its improvement by artificial means. The materials are on the spot, and by means of embankment way, even the smallest stream can be made to produce its full fertilizing influence upon the soil. To discern the places where embankments may be most fittingly raised requires considerable skill. But an eye accustomed to such observations will detect the ground where the water may be most easily retained, and where the work can be most advantageously undertaken.

Embankments, their uses.

The object of the embanking process is not merely to have a body of water that may be run off for the purposes of irrigation. This, though a legitimate end in many situations, is not always attainable. A tank, although it holds water only for a certain period of the year, may still serve a useful purpose by its effects in diffusing moisture throughout the neighbouring soil, and which may thus be rendered fit for cultivation. Some of the richest looking cultivation in the district is to be seen immediately along the margins of the tanks, and, progressively, in its bed as the waters recede. Another grand object, and the primary one in many cases, in the formation of these tanks, is the replenishment of the wells. Very many of the wells in this district would completely fail in bad seasons, or yield a most insufficient supply, except for the influence they derive from the neighbourhood of tanks: and here may be seen the admirable beauty and utility of such works, and the inestimable benefit they confer in a district of country where the fall of rain is frequently scanty and at all times precarious. The water, whatever the season supplies, is kept as in a stone house. It may sink into the earth; but can be again drawn forth and poured upon the surface, which thus becomes fertilized in the time of need.

Wells.

The wells, as to quantity of water and its distance from the surface, will of course vary with the state of the tank, at least all those so situated as to be affected by tanks. After a season of plentiful rain like the past, the water in most of the wells is abundant and moderately near the surface. From 30 to 40 or 45 feet* may be about the average depth at which water is obtained, but in this there is considerable variety according to situation and other circumstances. When the rains have been scanty, the supply in the wells is also apt to be scanty, and may fail during the hot weather. With the ground

* I have not noticed the depth of water in the wells. I did not observe this was required till after visiting the villages. Here is 30 feet water at depth of 30 feet, which may be near the average of permanent as distinguished from temporary wells this year.

so saturated as it is now, there need be no apprehension on this point. Even a season of "drought" ensuing after one like the past would be but partially felt.

Water of the wells and tanks, the difference.

There is a considerable difference in the chemical proportion of the water as taken from wells or from tanks. The tank water is generally much less impregnated with salts and therefore preferable for domestic purposes and most agricultural ones; so much so is this the case that in many parts the villages may be seen to use the muddied "tank water" in preference to that from the wells. Where the soil contains a large amount of salt, the well water becomes entirely unfit for irrigation. This is the case in some parts of the Ramsur district, where the salt effloresces abundantly on the surface. The evil is corrected in some degree by the use of tank water, and but for this the extensive khets to be seen in that neighbourhood could have no existence. Some crops, however, as the barley, suffer less from this saline impregnation. At the station of Nusseerabad, from the want of tank water, little or nothing can be done in the way of cultivation. Gardens there are next to useless, and the best efforts lead but to disappointment. At Ajmeer, and this neighbourhood generally, the case is different. The well water is good and answers for irrigation.

Re-agents, effects of, with the water.

Water entirely free from saline impregnation is not to be found either in the wells or the tanks. From the water of all the wells I have examined the nitrate of silver throws down a copious precipitate. The "Ana Sagur" water, which is that of the lake, gives a precipitate but very much fainter. In other parts of the district, I have observed the same difference in relation to tank and well water. The oxalate of ammonia gives a distinct precipitate with the "well water" of Ajmeer, but there is none with that of the lake. Solution of pure potass causes a faintish precipitate with the well, but not with the lake water. The nitrate of barytes causes a precipitate with the well, but not with the tank water.

Irrigation, its effects as to the health of cultivators.

As to the effect of the irrigation practised in this district upon the health of the cultivators, information will be best gathered by a reference to the result of my enquiries on that point contained under the head marked B. The investigation was carried on by myself on the spot, and in the manner directed. Taking the results obtained as affording a criterion by which to judge of the healthiness of the cultivators throughout this district, it certainly leads to the conclusion that irrigation, as here practised, is not in any high degree injurious. The sufferers from spleen are chiefly children. As regards European children, particularly young children, I may remark that the climate of this part of India, as far as my experience goes, is not the most favourable. To my questions on the subject of fever, I found it difficult, I may say

impossible, often to obtain precise answers. Whether from wilfulness or forgetfulness, the latter I believe most generally, there seemed very often no distinct recollection on the part of individuals as to whether they had suffered from attacks of fever in previous years or not. On this subject a good many mis-statements may have been made. The probability is, that when there was an indistinct recollection as to the occurrence of fever, it could not, in such cases, have been of a serious or debilitating kind.

Cultivators, their healthy looks.

To form a judgment as to the health of the inhabitants from their looks and appearance, there was the best evidence every where that they were far from an unhealthy race. Indeed, in few of the villages visited could I make out any considerable amount of disease. Among the most common complaints were chronic skin diseases, rheumatism, old and indolent ulcers. A good many *prematurely* old looking persons were to be found, but there is more reason to believe this a consequence of hard work and indifferent food than any effect on their constitutions produced by the climate or soil.

Questions as to effect of irrigation.

I made enquiries on many occasions, as to whether, with the increase of irrigation, there had been observed any increased amount of sickness. The reply was uniformly in the "negative." So much more, amongst them, does consideration attach to "plenty" than to health, that the enquiry seemed to be looked upon as a highly absurd one.

The circumstances under which the irrigation is practised and which tend to render it so little hurtful, I conceive to be chiefly the following:

General nature of the climate.

The climate is essentially a dry one, and at the same time salubrious. The villages in respect to the irrigated land are almost invariably high in point of situation. For the most part they rest on the slope of a hill, either near its base or on the steep itself; or they extend along some rocky ridge.

The villages how situated.

The village of Ramsir, for instance, situated as it is with a lake on one hand (and this apt to dry up in some seasons), and a freely irrigated country on the other, might certainly, from its position, be looked upon as a very *focus* in respect to malaria, yet still, as far as enquiry enabled me to find out, no great unhealthiness appears to prevail. What, in the main, conduces to this favorable, and, so far as appearances go, unexpected state of things, is, I doubt not, the situation of the village, high and dry and upon a rocky ridge. The elevation of the ridge is inconsiderable, but still the houses built upon it may be considered well placed, and in some degree removed from the immediate influence of the soil.

Nature of crops irrigated.

The most sickly time of the year is the month of October; and during this month and early in November the days are hot and the atmosphere contains much moisture. Besides this, I believe, that the newly upturned and newly irrigated soil is the most apt to give forth noxious exhalations. The *after irrigation*, provided the fields be kept free of weeds as they are here, has little if any injurious effect. The fields regularly irrigated are those of the wheat and barley, and the work goes on with little intermission until February. Irrigation is practised for other crops, at different seasons, but to a trifling extent only.

The soil as affected by irrigation.

The circumstance chiefly operative as regards the health of the people employed in irrigation in this district, I conceive to be the "absorbent nature of the soil." The underlying rocks, too, have a highly absorbent character, and hence water poured upon the surface sinks into the earth speedily. It is owing to this property of the soil that the clothing of herbage is everywhere so scanty. Soon after the first early rain the grass springs up, and the dry, burnt up waste becomes overspread with *green*. When the rain has ceased, or very soon after, a change in the appearance of the scene takes place. The surface becoming dry, the more delicate grasses wither, and nothing has a thriving aspect but the wild shrubs and bushes such as the "ah," the kunserah, the "kenail," &c., which delight in a barren soil. Trees, when they have once struck their roots deep into the earth, and can draw from it moisture for their own support, thrive well, but, until they have arrived at this stage of growth, require much care and tending. Hence so few are to be seen, and those only in the vicinity of villages.

It is easy to understand why a soil of this kind should be less injurious under the influence of irrigation than one of a different description, where the vegetation becomes more luxuriant, and where, at certain times, it is liable to decay and decomposition. Another favourable circumstance as regards this district is the little disposition of water to stagnate. The ground being inclined more or less in all parts, water runs freely, and conducted into a tank, is in the condition least of all likely to have any prejudicial effect. It is only in the immediate vicinity of Ajmere itself (at the Daulut Baugh, and in front of the magazine), that I have observed any ground covered by water in a stagnant state, and in a state likely to give forth unwholesome exhalations. From the overflowing of the Ana Sagur lake this was partly unavoidable, during the rains at least, but the evil has been allowed to exist long after the remedy, the simple one of draining, might have been applied. That this state of things has produced the great

Inclination of the surface.

Stagnant water.

amount of fever that has prevailed in the town the last season, I am not prepared to say: but it may have had some effect. Other apparent causes exist; and the season moreover has been generally an unhealthy one, although not so, in a great degree seemingly in the smaller villages of the district.

Swamps and marshes.

One point on which information is desired is as to the amount of ground in a state between "dryness and moisture." Of natural swamps or marshes there are none, so far as I know, in the district. A few swampy spots there may be after heavy rains, but not such as to give any cause for apprehension. The condition of the Ramsir lake I have not observed at all seasons: some portion of its bed may possibly remain in the state of a swamp during the hot weather, but how much or in what *precise* condition, I am not able to say. The only *permanently* swampy ground I have observed has been immediately in the vicinity of tanks and produced either by leakage through the bund, or by water finding its way by percolation underneath. The ground in this direction, so long as there is water in the tank, remains generally *moist*, and this term expresses its condition in most cases better than swamp.

The drying up of the tanks begins in the opposite direction, or towards the source of supply. When there is much clay in the ground, the surface becomes hard, and *cakes* as the water gradually recedes. When there is a due proportion of vegetable mould the soil here is of the best description and affords the richest cultivation.

Drying up of tanks.

It is when lakes are in a process of drying that they are most likely to be injurious by giving out malaria. When there is plenty of water in the Ana Sagur lake no place is more desirable as a residence than the bund; but it is not so in particular seasons when a large portion of the bed of the lake has dried up. Most of the other lakes in the Ajmere district are small in comparison, and injurious consequences from this source need not be apprehended.

(True Copy.)

(Signed) W. E. BAKER, Major,

President Canal Committee.

ABSTRACT of Medical Examinations referred to in the foregoing Report.

Villages.	Children of all Classes.		Adults. Brahmins, Fukeers, &c.		Hindoo Cultivators.		Mussulman Cultivators.		Bunnias.		Artizans, &c., &c.		Menials.		Totals.		Percentage of enlarged spleens.	Depth of water below surface of ground.	Detail of sizes of enlarged spleens.						Percentage of adults having suffered from fever in		
	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E		Feet	VL	L	M	O	S	Total.	1844	1845	1846
Tabeejee, ...	17	3	4	1	5	1	1	0	5	0	1	0	2	1	17	3	15	30	0	0	0	0	6	6	5	20	30
Ramsir, ...	17	3	0	1	2	1	6	2	6	0	1	0	1	0	16	4	17⅓	5	0	0	0	1	6	7	0	45	35
Dubreila, ...	19	1	1	0	14	0	0	0	2	0	2	0	0	1	19	1	5	25	0	0	0	1	1	2	20	10	25
Neepoolie, ...	20	0	0	0	18	0	0	0	2	0	0	0	0	0	20	0	0	12	0	0	0	0	0	0	5	5	5
Saproonda,...	18	2	0	0	9	2	0	0	1	1	2	0	5	0	17	3	12½	25	0	0	0	1	4	5	5	5	20
Teharie, ...	14	6	2	1	6	1	0	0	5	3	0	1	1	0	14	6	30	5	0	0	0	1	11	12	30	25	5
Jalowrie, ...	17	3	0	0	3	1	10	4	0	0	0	0	1	1	14	6	22½	0	0	0	1	3	5	9	20	75	90
Nareillee	12	8	0	0	16	0	0	0	0	0	0	0	4	0	20	0	20	15	0	0	0	3	5	8	0	15	25
Googra, ...	18	2	0	0	18	2	0	0	0	0	0	0	0	0	18	2	10	12	0	0	0	1	3	4	0	5	15
Akhurrie,...	13	7	0	0	11	2	0	0	1	0	0	0	4	2	16	4	27⅓	25	0	0	3	2	6	11	0	35	45
Chacheawas, ...	18	2	0	0	12	1	0	0	1	0	0	0	4	2	17	3	12½	28	0	0	0	0	5	5	5	10	20
Mohurwatee, ...	17	3	0	0	10	1	1	0	5	1	1	0	0	1	17	3	15	0	0	0	0	1	5	6	5	10	10
Boorhee Pokhur, ...	16	4	0	0	16	2	0	0	0	0	1	0	1	0	18	2	15	17	0	0	1	3	2	6	0	15	15
Sirhadana, ...	17	3	2	0	9	3	0	0	2	1	0	0	1	2	14	6	22½	20	0	0	0	0	9	9	5	20	35
	233	47	9	3	149	17	17	6	30	6	8	1	24	10	237	43	16	18							7½	21	27

[True Abstract] (Signed) W. E. BAKER, Major *and President.*

APPENDIX K.

From N. COLLYER, ESQUIRE, *Assistant Surgeon, Mhairwara Local Battalion, to Major* W. E. BAKER, *President Canal Committee, dated Beawr, 4th February,* 1847.

SIR,—I have the honor to forward for your information the accompanying statement of an examination of 12 villages conducted by me in accordance with the prescribed form contained in your letter, dated 11th December, 1846; and I beg to state that for the purpose of investigation I have selected those villages which have the largest tanks and the most extensive irrigation. I am sorry to state that I have not succeeded in procuring the full complement of children, from their parents having taken them away into the jungle at hearing of my presence, being influenced, I suppose, by fear or prejudice through ignorance of the cause for which I required their presence. I trust however that the number of children contained in my report will be found sufficient to indicate the general healthiness of the district and its freedom from ague and spleen.

The general character of the cultivated soil in the immediate vicinity of the hills is of a dark, rich, loamy description, and very productive. It consists of disintegrated mica, schist, and felspar, combined with decomposed vegetable matter and salts of alumina, silica, and potash, with oxide of iron. In other parts it is of a lighter kind, and abounds with aluminous and cretaceous marls. It is of a highly absorbent nature, the surface of the land quickly becoming dry after the heaviest falls of rain. The surface of the irrigated parts inclines naturally from the bed of the tulao.

The rain crops consist of Bajra, Til and Moong with Moth, and are sown without manure in June, and likewise Mukka, Tobacco and Cotton, which are manured.

The rubbee cultivation commences at the end of October, and consists of Wheat, Barley, Gram, Sursoo and Opium; and such as are irrigated, if they escape the severe frosts and hail storms, yield a plentiful crop. Irrigation commences in November, and is continued until the end of February or beginning of March.

On the secession of the water the land is ploughed up as soon as it can be worked, and sown with the rubbee crop until the 15th of December. Such portion of the bed of the tank as becomes available for cultivation is sown during the months of February, March and April with Mukka. Thus the inconveniences likely to arise from the gradual drying up of the soil is obviated by its being immediately sown with corn. In view to increase the subsistence of the people the water-nut is freely cultivated on the surface of various of the tulaos, and without any apparent detriment to health. Moist swampy ground abounding with a variety of coarse grasses, and covered with a saline efflorescence

(impure sub-carbonate of soda) prevails very generally on the rear of the embankments of all the tulaos.

The diet of the inhabitants consists chiefly of Barley and Mukka with Dal of Moth, Moong, Lobya and Oorud ; they are clothed in coarse cotton cloths, and appear very cheerful and contented.

It is a characteristic of the Mhairs that they always locate their villages on heights : hence in a measure may be attributed their general good health.

From about the 15th January to the end of September the prevailing wind is from the south-west. During this period it generally blows strong and steady. During the remaining portion of the year, should any wind blow, it is from the east.

The hills in Mhairwara are all of the primitive formation, and embrace all the varieties of rocks usual under such circumstances: they are principally formed of granite, having separate beds of mica, quartz, felspar with hornblende and veins of granular limestone; gneiss is in great abundance, and is used for slabbing the roofs of houses.

The depth of the soil varies greatly in different situations. It is formed of the debris of the hills, mixed up with decomposed vegetation. As a consequence, it is deeper in the valleys than on the slopes of the hills ; the greatest depth may be taken at 10 feet, while in other places it is restricted to a slight covering of only a few inches.

In conclusion, I would beg leave to remark that from the observations I have made and from information I have gleaned from other sources, the impression on my mind is that hitherto no deleterious effects have arisen affecting the health of the inhabitants of Mhairwara either from the large bodies of water which have been collected by the tanks, or from the use of that water while being employed largely for the purposes of irrigation.

(True Copy.)

(Signed) W. E. BAKER, Major,

President Canal Committee.

ABSTRACT of Medical Examinations alluded to in the foregoing Report.

Villages.	Children of all Classes.		Adults.														Percentage of adults having suffered from fever in			Percentage of enlarged spleens.	Depth of water below the surface of ground.	Detail of sizes of enlarged spleens.					
			Brahmins, Fukeers, &c.		Hindoo Cultivators.		Mussulman Cultivators.		Bunnias.		Artizans, &c, &c.		Menials.		Totals.												
	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E	1844	1845	1846		Feet	VL	L	M	O	S	Total.
Dilwara, ...	20	0	1	0	8	0	0	0	2	0	4	1	3	1	18	2	0	5	40	5	2	0	0	0	1	1	2
Bulhar, ...	20	0	0	0	13	2	1	0	1	0	2	0	1	0	18	2	0	5	15	5	6	0	0	0	1	1	2
Purvrish, ...	10	0	0	0	10	0	0	0	0	0	2	0	7	1	19	1	0	0	10	$3\frac{1}{3}$	0	0	0	0	1	0	1
Beawr, ...	20	0	1	0	5	0	0	0	6	1	7	0	0	0	19	1	0	0	15	$2\frac{1}{2}$	18	0	0	0	1	0	1
Kullinjur, ...	20	0	0	0	16	0	0	0	1	0	2	0	1	0	20	0	10	0	0	0	6	0	0	0	0	0	0
Gohanna, ...	0	0	0	0	18	0	0	0	0	0	1	0	1	0	20	0	0	0	0	0	$7\frac{1}{2}$	0	0	0	0	0	0
Nurbudea Khera, ...	17	0	0	1	12	0	0	0	0	0	1	0	6	0	19	1	0	15	0	$2\frac{2}{3}$	6	0	0	0	1	0	1
Dewanta, ...	8	0	0	0	6	0	0	0	0	0	1	0	8	2	15	2	0	0	0	8	6	0	0	0	2	0	2
Jowaja, ...	16	1	0	0	15	0	0	0	3	0	0	0	2	0	20	0	0	0	0	$2\frac{2}{3}$	$4\frac{1}{2}$	0	0	0	0	1	1
Loosanee, ...	15	1	0	0	9	1	0	0	1	0	4	0	5	0	19	1	$2\frac{3}{4}$	0	0	$5\frac{1}{2}$	$4\frac{1}{2}$	0	0	0	1	1	2
Kabree, ...	15	1	1	0	13	1	0	0	0	0	4	0	1	0	19	1	$2\frac{3}{4}$	$2\frac{3}{4}$	0	$5\frac{1}{8}$	$4\frac{1}{2}$	0	0	1	1	0	2
Kallee Konkur, ...	11	0	1	0	6	0	0	0	2	0	1	0	9	1	19	1	0	$9\frac{2}{3}$	0	$3\frac{1}{4}$	9	0	0	0	1	0	1
	172	3	4	1	131	4	1	0	16	1	29	1	44	5	225	12	$1\frac{1}{4}$	3	$6\frac{2}{3}$	$3\frac{1}{4}$	6						

(True Abstract) (Sd.) W. E. BAKER, Major,
President.

DR. *Expenditure on the Canals West of the Jumna in Account*

	Original Work.			Establisbment.			Current repairs.			Total.		
	Co .'s Rs.	A.	P.	Co.'s Rs.	A	P.	Co.'s Rs.	A	P.	Co.'s Rs.	A	P.
As per Captain Blane's bills from commencement up to 18tb May, 1821, ..	142164	10	9½	52264	9	11	5319	13	7½	199749	2	4
As per Captain Colvin and Tickell's bills, from 19th May, 1821, to 80th April, 1822, ...	0	0	0	19095	9	4	6586	11	6	25682	4	10
As per do. do. bills of 1822-23, ...	0	0	0	27612	15	6	9303	2	3	36916	1	9
As per do. do. bills of 1823-24, ..	0	0	0	43815	5	7½	6743	10	6	50559	0	1½
As per do. do. bills of 1824-25, ..	0	0	0	53381	2	5⅝	4181	12	5	57562	14	10⅝
As per do. do. bills of 1825-26, ..	0	0	0	59029	9	2½	4580	4	5	63609	13	7½
As per do. do. bills of 1826-27, ..	4141	10	0	64484	13	2	6830	12	5	75457	3	7
As per Captain Colvin's bills of 1827-28, ...	18145	9	10	73141	7	7	7288	13	8½	98575	15	1½
As per do. do. bills of 1828-29, ..	0	0	0	74216	1	1	9661	9	1	83877	10	2
As per do. do. bills of 1829-30, ..	4938	14	0	74851	15	7	10435	9	3	90226	6	10
As per do. do. bills of 1830-31, ..	0	0	0	77121	1	1	16252	14	2	93373	15	3
As per do. do. bills of 1831-32, ..	0	0	0	79718	14	7	20401	5	11	100120	4	6
As per do. do. bills of 1832-33, ..	0	0	0	82242	5	7	22959	8	5	105201	14	0
As per do. do bills of 1833-34, ..	72010	15	4	81100	0	3	21402	14	8	174513	14	3
As per do. do. bills of 1834-35, ..	90278	8	8	77646	8	4	36165	5	3	204090	6	3
As per do. do. bills of 1835-36, ..	622222	9	3½	78949	5	0	25657	8	6½	726829	6	10
As per Lieut. Baker's bills of 1836-37, ...	3383	7	8	65492	5	5	21892	14	10½	90768	11	11½
As per do. do. bills of 1837-38, ..	31743	2	1	58727	7	2	34804	7	4	125275	0	7
As per do. do. bills of 1838-39, ..	46044	0	11	57201	10	4	21073	11	5	124319	6	8
As per do. do. bills of 1839-40, ..	5562	14	0	54855	13	10	27758	0	8	88869	12	6
As per Captain Baker's bills of 1840-41, ...	31181	1	7	57066	8	5	25785	11	3	114033	5	3
As per do. do. bills of 1841-42, ..	12120	15	9	55425	14	8	28197	9	7	95744	8	0
As per do. do. bills of 1842-43, ..	25115	14	0	53104	15	11	43915	4	5	122136	2	4
As per do. do. bills of 1843-44, ...	8408	11	9	59721	3	0	31712	15	9	99842	14	6
Total cost up to end of 1843-44, ..	1118156	1	8	1480267	11	0⅓	448912	7	5	3047336	4	1⅓
As per ditto, 1844-45, ..	2689	6	3	67069	11	8	89689	14	5	159399	0	0
As per ditto, 1845-46, ..	17184	0	5	68238	1	4	62559	2	4	147981	3	11
As per ditto, 1846-47, ..	56769	6	4	71859	4	0	53976	10	6	182605	4	11
Total cost up to end of 1846-47, ..	1194748	14	8	1687344	11	7⅓	656188	2	8	3537321	12	11⅓

Current with direct Canal Revenue derived thereupon. *Cr.*

	Water rent on land irrigation.			Rent on the water Mills.			Rent on cattle watered.			Rent for rafting timbers.			Sale of the Canal produce and all sundry rents.			Fines for breach of Canal regulations.			Total direct Revenue.		
	Co.'s Rs.	A	P	Co.'s Rs.	A	P	Co.'s Rs.	A	P	Co.'s Rs.	A	P	Co.'s Rs.	A	P	Co.'s Rs.	A	P	Co.'s Rs.	A	P.
Previous to 1820, ..	876	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	876	4	0
1820-21, ..	14646	2	1	0	0	0	0	0	0	14	4	0	635	11	0	504	8	5	15800	9	6
1821-22, ..	24618	8	11	0	0	0	0	0	0	84	4	0	1180	9	4	911	8	2	26794	14	5
1822-23, ..	21458	5	0	3026	13	6	0	0	0	0	0	0	741	7	11	1039	2	10	26265	13	3
1823-24, ..	36015	6	1	6868	10	0	0	0	0	0	0	0	656	0	10	1882	3	8	45422	4	7
1824-25, .	26646	9	7	3964	5	4	0	0	0	0	0	0	545	7	7	1082	8	8	32238	15	2
1825-26, ..	48374	6	9	2991	3	11	0	0	0	0	0	0	370	9	9	2423	4	4	54159	8	9
1826-27, ..	33975	0	0	3682	18	2	0	0	0	500	4	0	713	13	11	3283	1	6	42155	0	7
1827-28, ..	34160	14	7	11676	10	9	0	0	0	1013	1	10	1460	13	9	4471	1	9	52782	10	8
1828-29, ..	52952	10	7	16267	0	6	3772	10	8	1187	1	10	1289	8	8	2847	6	2	78316	6	5
1829-30, ..	53375	0	0	19786	3	0	3568	7	10	1932	10	4	1142	15	4	2801	12	4	82607	0	10
1830-31, ..	57700	0	5	19464	6	0	2968	12	2	2132	8	4	1265	4	8	2508	9	6	86039	3	1
1831-32, ..	51016	4	11	19002	3	7	4210	9	7	2061	15	0	2127	7	0	2463	2	10	80881	10	11
1832-33, ..	65804	11	3	19238	2	3	3396	2	5	1611	8	7	2651	2	11	3410	4	5	96111	15	10
1833-34, ..	148783	2	6	13882	4	6	1257	3	11	2950	1	6	3894	6	11	6064	11	3	176831	4	7
1834-35, ..	114065	8	3	18294	9	9	1669	6	7	3238	9	5	3682	2	10	4303	2	10	145253	17	8
1835-36, .	110602	11	3	22837	3	7	2145	15	6	1993	9	0	4957	11	9	2603	13	4	145141	0	5
1836-37, ..	153176	15	1	26894	10	5	2197	1	7	3365	0	0	2245	6	0	2930	5	3	190809	6	4
1837-38, .	272377	13	5	5782	0	9	760	3	6	6048	9	5	5221	8	8	9480	8	9	299670	12	6
1838-39, ..	189644	15	3	9732	7	10	1838	15	3	8228	11	4	6171	4	2	5783	12	0	221400	1	10
1839-40, ..	224382	15	3	14566	8	3	2286	13	2	6579	5	1	4822	14	10	6188	2	2	258826	10	9
1840-41, ..	225817	15	3	9524	0	6	1955	13	2	9730	4	3	5481	6	0	6077	13	0	238587	4	2
1841-42, ..	263068	13	0	8203	14	3	1554	1	8	11505	15	3	5607	3	7	4682	9	6	294572	9	3
1842-43, ..	279300	10	11	9382	11	9	1172	5	2	7934	14	9	6756	12	3	6218	1	0	311265	7	10
1843-44, ..	260555	8	9	12598	13	0	1680	4	9	5570	12	6	4827	5	2	5760	14	3	290993	10	5
	2793397	5	1	278167	6	7	36434	14	11	76837	6	5	68449	2	10	89672	7	11	3343804	11	9
1844-45, ..	231022	8	9	8220	6	3	2979	7	2	6598	10	8	5149	11	1	6341	8	2	260311	15	1
1845-46, ..	260693	13	2	13250	7	11	2293	3	3	7830	0	4	7056	0	1	7753	4	6	298876	13	3
1846-47, ..	262529	13	8	14709	15	5	1687	0	0	6799	9	1	10167	10	4	6991	2	9	302885	8	8
	3547643	8	8	43304	9	4	43304	0	0	98911	10	6	90822	8	4	110758	2	4	4205878	11	4

Dr. *Expenditure on the Dooab Canal in Account Current*

	Original Work.			Establishment.			Current repairs.			Total.		
	Co 's Rs.	A.	P.	Co.'s Rs.	A.	P.	Co.'s Rs.	A.	P.	Co.'s Rs.	A.	P.
As per Captain Smith's Bill from commencement to 31st December, 1830, ...	311239	12	4½	122831	0	6	0	0	0	434070	12	10½
As per Captain Cautley's audited bills from 1st January to 30th April, 1830,	0	0	0	3924	12	0	0	0	0	3924	12	0
Ditto ditto of 1830-31, ...	0	0	0	29658	10	2¾	3958	1	9 11/12	33616	12	0⅔
Ditto ditto of 1831-32, ...	12022	4	9½	47905	11	2½	4476	0	9¼	64404	0	9
Ditto ditto of 1832-33, ...	11153	7	5	27870	5	9	10929	13	0½	49953	10	2½
Ditto ditto of 1833-34, ...	19370	18	10	31767	14	5	20517	13	0½	71656	9	3½
Ditto ditto of 1834-35, ...	40256	10	6	30999	10	7	24295	8	3½	95551	13	4½
Ditto ditto of 1835-36, ...	36583	7	0	29870	1	11	24234	8	0	90688	0	11
Ditto ditto of 1836-37, ...	26599	7	10	41044	4	8	30274	0	5½	97917	12	11½
Ditto ditto of 1837-38, ...	8744	8	10	32727	8	0	24909	11	5	66381	12	3
Ditto ditto of 1838-39, ...	33208	1	10	33820	2	1	33453	9	9	100481	13	8
Ditto ditto of 1839-40, ...	113S	14	6	33462	7	10	40518	8	4	75119	14	8
Total cost up to end of 1839-40, ..	500317	8	10½	465882	9	2¾	217567	10	11⅛	1183767	11	11 11/12
Ditto ditto of 1840-41, ...	25168	5	8	34479	2	0	34642	5	1	94289	12	9
Ditto ditto of 1841-42, ...	99396	10	3	34794	10	1	30644	11	9	164836	0	1
Ditto bitto of 1842-43, ...	10609	4	9	33971	13	9	37740	2	7	82321	5	1
Ditto ditto of 1843-44, ...	119605	1	3	31230	7	1	85876	7	11	186712	0	3
	755096	14	9½	600358	10	1¼	856471	6	3⅛	1711926	15	1 11/12
Ditto ditto of 1844-45, .. .	80335	2	5	30738	11	0	30981	12	1	92055	9	6
Ditto ditto of 1845-46, ...	11427	0	0	33900	10	8	34054	2	6	79381	8	2
Ditto ditto of 1846-47, ...	17683	2	1	34538	9	0	88800	7	9	91072	2	10
Total cost up to end of 1846-47, ..	814592	3	3½	699586	8	9¼	460257	12	7⅛	1974436	8	7 11/12

with direct Canal Revenue derived thereupon. Cr.

	Water rent on land irrigated.			Rent on the water mills.			Rent on cattle watered.			Rent for rafting timbers.			Sale of the Canal produce and all sundry Rents			Fines for breach of Canal regulations.			Total direct Revenue.		
	Co.'s Rs.	A.	P.	Co.'s Rs.	A.	P.	Co.'s Rs.	A.	P.	Co.'s Rs.	A	P	Co.'s Rs.	A	P.	Co.'s Rs.	A.	P.	Co.'s Rs.	A	P.
1830-31,	6083	5	9	884	12	5¾	2	4	4½	0	0	0	592	15	3	730	0	3½	8293	6	1¾
1831-32,	7551	2	2	2476	10	2	107	3	2	9	7	9½	606	6	2	1209	0	8	11959	14	1½
1832-33,	22107	0	0	4902	15	10¾	83	14	5	11	12	3½	665	7	7½	1075	13	0	28846	15	2¾
1833-34,	46964	15	2	4435	13	4½	52	5	6½	7	5	2½	773	11	8	1270	1	5	53504	5	4¼
1834-35,	37918	5	6	3335	6	5	100	12	5	0	0	0	815	15	5¼	1250	12	1	43421	3	10¼
1835-36,	37081	5	3	4728	0	7¼	63	13	0	0	0	0	1034	9	4	1325	1	4	44232	13	6¼
1836-37,	44308	6	0	5154	11	2½	61	10	0	88	12	4½	1168	5	2	735	10	7	5151	7	7¼
1837-38,	91315	9	1	5001	6	9	189	13	0	262	3	0	1222	5	2	2847	14	6	100839	3	6
1838-39,	73014	15	10	4358	4	6	104	0	0	426	8	1	1073	9	1	2967	13	0	81945	2	6
1839-40,	78543	9	11	4288	4	2	65	14	0	566	12	7	1282	8	0	3812	6	9	88559	7	5
	444888	10	8	39566	5	6¾	831	9	11	1372	13	4	9235	12	10¾ Rs.	17224	10	7½	513119	15	0
1840-41,	89135	14	6	3297	9	2	97	14	0	0	0	0	2470	0	5	4322	8	11	99323	15	0
1841-42,	78885	8	5	5733	12	6	153	14	0	963	2	11	1645	3	5	3785	6	1	91164	15	4
1842-43,	107064	0	8	6194	0	9	32	10	0	522	2	8	1940	7	6	3683	0	3	119436	5	10
1843-44,	86147	1	3	8178	13	0	137	4	0	351	5	11	1413	12	9	4535	4	4	100763	9	3
	806121	3	6	62970	8	1¾	1253	3	11	3209	8	10	16705	4	11¾	33548	14	2½	923808	12	5
1844-45,	84786	2	0	6045	4	3	217	15	0	280	14	5	1704	1	11	5736	4	7	98770	10	2
1845-46,	96534	4	4	8121	15	8	103	8	0	414	10	9	1725	11	1	3086	6	11	109986	8	9
1846-47,	107725	1	8	7838	0	6	305	0	10	609	2	1	1842	0	11	3433	6	7	121752	21	7
	1095166	11	6	84975	12	6¾	1879	11	9	4514	4	1	21977	2	10¾	45805	0	3½	1254313	11	11

General Summary of Expenditure on the Ganges Canal to 31st August, 1845.

Establishment—From Commencement to 31st August, 1845, and general Superiutendence from 1st September, 1843, to 31st August, 1845,...	95,285	14	1
Sundries—Including extra Draughtsmen in Superintendent's office, ...	4,215	8	4
Excavation—Comprising about 10 miles of Canal channel completed, including the 1st annual repairs and grassing of slopes about 6 miles of Caual channel in progress and heavy excavation of shingle at site of the Myapoor Dam and Regulator also in progress, ...	3,77,639	1	1
Masonry Works—Comprising the foundations of the Myapoor Dam and regulating Bridge, rivetments of the high gravel banks adjoining thereto up to the height of 5 feet. The foundations of a bathing Ghat and the Bythuk wall at Myapoor. The road and inlet Bridges of the Bochna nulla, work shops at Myapoor, model room and offices aud range of Smith's and Carpenter's shops; Store rooms, &c., at Roorkhee, 1st class chokies at Myapoor, Muhmoodpoor and Belra and 2nd class chokies at Munglour, Dimat and Toghulpoor, (not including cost of bricks used in them), ...	18,585	11	9
Brick making—Comprising the preparation of Government and contract kilns, and near the site of the principal masonry works as fuel could be obtained. Many of the kilns have totally or partially failed, an those of last year having not yet been unstacked, the precise number of serviceable bricks is not known, but may be roughly estimated at two hundred lacs,	1,19,318	0	1
Workshops aud purchase of store materials such as lime, iron, stoue &c.	36,460	0	9
Bullocks—Cost of maintaining to be charged hereafter to the works on which they were employed, ...	2,418	3	2
Compensation—For land and property, and remission of land revenue, ...	5,730	4	8
Grand total expenditure up to 31st August, 1845, Co.'s Rupees, ...	6,59,652	11	8
Present Monthly establishment of the Ganges Canal (including half the expence of the Director's office, the other half being fairly chargeable to the other Cauals under his superintendence,) Co.'s Rupees, ... ∴ ...	3,800	0	0

(Signed) W. E. BAKER, Captain,

Dirctor of the Works, Ganges Canal.

Statement of the gross value of crops grown on land irrigated from the Delhie Canals in 1837-38, *the greater part of which land would have been totally unproductive without the use of Canal water.*

KHUREEF CROPS.

		Co.'s Rs.	A.	P
20490	Beegas of Sugar-cane and Indigo at 50 Rupees per beega, ...	10,24,500	0	0
75242	Beegas of Cotton at 12 maunds of Kupas (or Cotton with seed) per beega and 16 seers of Kupas per Rupee,	22,57,200	0	0
74010	Beegas of Rice, Jowar, &c., at 15 maunds per beega, and 25 seers per rupee or 24 rupees per beega, ...	17,76,240	0	0

RUBBEE CROPS.

19000	Beegas of Wheat, Barley, Gram, Mustard, &c. &c., at 15 maunds per beegah, and 20 seers per rupee or 30 rupees per beega, ...	95,70,000	0	0
	Company's Rupees ...	1,46,27,940	0	0

In the above statement the produce per beega is stated at the lowest average of the statements I have collected from Zemindars of the produce of their fields, and will not be considered more than might be expected from land well cultivated and plentifully irrigated. The valuation is also lower than the market prices have been within my experience during the last six months. Of this sum of 146 lacs of rupees about 1-10th is recovered by Government on account of land-tax and water-rent ; the remainder covers the expences of cultivation and provides maintenance for the population of near 500 villages.

(Signed) W. E. BAKER, Lieut.,

Superintendent Canals.

Dated,
1838.

NOTES

ON THE

APPLICATION OF THE TEST

OF

ORGANIC DISEASE OF THE SPLEEN,

AS AN

EASY AND CERTAIN METHOD OF DETECTING MALARIOUS LOCALITIES IN HOT CLIMATES.

By SURGEON T. E. DEMPSTER,

MEMBER OF LATE CANAL MEDICAL COMMITTEE.

NOTES

ON THE

APPLICATION OF THE TEST

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ORGANIC DISEASE OF THE SPLEEN,

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EASY AND CERTAIN METHOD OF DETECTING MALARIOUS LOCALITIES IN HOT CLIMATES.

LETTERS.

From T. E. DEMPSTER, ESQ., *1st Brigade Horse Artillery, to* J. THORNTON, ESQ., *Secretary to Government N. W. P.—Dated, Loodiana the* 31*st January*, 1848.

SIR,—I have the honor to forward two colored Maps or Plans of the country gone over by the late Canal Committee, together with an explanatory memoir relating to subjects, either directly connected with that enquiry, or deduced from the observations made on that occasion. I have to solicit the favor of your submitting these documents to the Honorable the Lieutenant Governor, North-Western Provinces, in the hope that his Honor will be pleased to cause them to be placed on the Public Record, or to make such other use of them as he may deem conducive to the Public Service.

The Maps are compiled entirely from the Tables appended to the Committee's Report, and therefore contain no new facts; but they appear to me to place the former facts in a new, simple and striking point of view, and to exhibit at a glance the whole grounds of the Medical opinions expressed in the Report.

As the sole Medical Member of a Committee of Enquiry into sanatory questions of such vast public importance, I feel myself to be

in a position of no ordinary responsibility ; and however confident as to the general soundness of my opinions, I am naturally anxious to show precisely what these opinions are, and to place on record proof clear and undeniable, that I have advanced nothing but what is based on certain and well ascertained facts.

I have a strong conviction that the concluding portion of the accompanying paper will be found to contain matter calculated to be extensively useful in this country.

From J. THORNTON, ESQ., *Secretary to Government, N. W. P.. to* T. E. DEMPSTER, ESQ., *Surgeon, 1st Brigade, Horse Artillery, Late Member Canal Committee,—No.* 972, *dated Agra, the* 11*th March,* 1848.

Revenue Department.

SIR,—I am directed by the Hon'ble the Lieutenant Governor to acknowledge the receipt of your letter, dated the 31st January last, with its enclosure, being additional remarks by you as an Appendix to the Canal Committee's Report, and in reply to inform you, that your communication was not received in time to admit of its being bound up and circulated with the Committee's Report. The Lieutenant Governor is however so anxious to give publicity to all that will throw light upon the subject, that he has given directions for printing it uniformly with the Report.

PLAN Nº 1.

APPENDIX.

ALTHOUGH the Tables and figured Abstracts appended to the Report of the Canal Committee comprise all the results of the Medical examinations, as well as information on various other points connected with the enquiry, they fail to shew the relative position of the places visited. This appears to me to be a defect which I have attempted to remedy by the construction of the two accompanying Plans. When the eye sees at a glance, not only the percentage of organic disease found in each town and village, but also their relative positions, both to the Canal and to each other, the effect on the judgment is far more striking and convincing than could be produced by any other method of dealing with a question of this nature.

2nd. The percentages of spleen disease and classification of the villages are faithfully copied from the Tables appended to the Committee's Report; in fact these Plans are only the Tables in another form. The several villages, &c., are laid down from my private notes and not from any authentic Maps or Survey. In doing this I make no pretension to minute accuracy, and mistakes in distances will often be found; but I believe the whole is sufficiently correct for the particular purpose I have in view.

3rd. I have considered the present a good and fitting opportunity for entering more minutely than could have been done in the Report, into the chain of reasoning by which I arrived at the Medical opinions expressed in that document.

4th. The line of villages lying between Rohtuck and Hansie, and two villages to the east and two to the west of the Town of Gohana, (all of which are included within *dotted lines*) were examined during our first expedition in December 1845, and were not again visited in 1846-47: all these places were excluded from the Tables for reasons fully explained in the Report. I have, however, thought it desirable to introduce them here into one general view, accompanied by such explanation as will insure their fair and proper use.

Plan No. I.

5th. Of 21 localities visited in two succeeding years, viz. 1845-46 and 1846-47, the average of spleen disease for the former season was 42·50 per cent.; and for the latter 37·19 per cent. These results are sufficiently near to secure some confidence in the general fidelity and usefulness of both sets of observations; and the trifling difference of 5·31 per cent. in favor of 1846-47, is amply accounted for by the acknowledged superior salubrity of that season over the

two or three immediately preceding; there is therefore nothing unfair (as far at least as canal irrigation is concerned) in now comparing these villages with those examined a year later; for if a corresponding decrease in spleen disease had taken place in them, the comparison would have given a trifle more in favor of the unirrigated parts. The numbers within the dotted lines, I believe, may be safely taken as they stand, and they will be found to complete a very important chain of observations. It is much to be regretted that our enquiries in this part of the country were so much confined to places in the immediate vicinity of the Canal. The reason of this has already been fully explained; but it may not be unimportant here further to state, that I was entirely ignorant of the nature of the country to be gone over, and that whenever we did diverge to the right or left (although of course consulted on the occasion) I necessarily put myself under the guidance of Major Baker. This will remove all suspicion that I selected favorable specimens of unirrigated localities: indeed, during the whole course of the enquiry I made it a rule to interfere as little as possible, either with the particular places, or particular persons to be subjected to examination. It is however also due to Major Baker, to record my entire conviction of his scrupulous impartiality throughout the investigation; and to state, that along the whole course of the west of Jumna Canals he advisedly selected the *worst* localities, and conducted me to every Canal, Town or Village, known or reported to be the most unhealthy.

6th. If any reliance is to be placed on the general fidelity of the Medical examinations, no one can cast his eye over the Plan without being struck with the astonishing difference between the numbers belonging to the irrigated and unirrigated parts; or at once acknowledging, that some cause or causes, intimately connected with *this* Canal, contribute in a remarkable degree to the production of spleen disease.

7th. Run the eye up the Rohtuck branch as far as Gohana, and compare the two unirrigated villages on the east bank of the Canal, with any two irrigated ones in the vicinity. The difference is great, but perhaps, it is accidental and depending on causes unconnected with Canals or Canal irrigation. Begin then again at Rair, the head of the Delhie branch, proceed downwards noting the numbers as you pass the eye along; stop at Jooah, look towards the west and contrast the group of unirrigating villages with any equal number from Rair to Delhie which use Canal irrigation. The difference here is indeed most remarkable. Surely this is more than accidental!

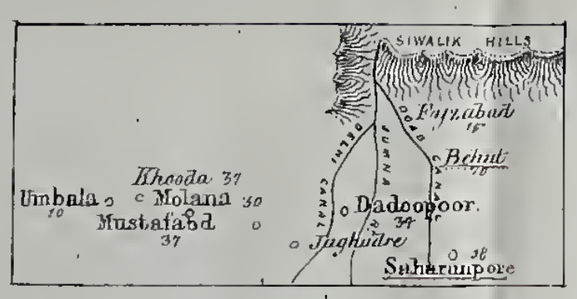
8th. Pursue now the long lines of unirrigated villages from the west of the Nujufghur Jheels to within a few miles of Hansie, and from the termination of the Bootana branches to the same point. Compare the numbers with those belonging to any irrigated tract to be found in this Plan; but especially observe the sudden and remarkable change which occurs the moment we come within the irrigated

PLAN Nº 2.

SIWALIK HILLS

Fyzabad 11
Tanda 0
Nyal Thakur (2)
Raipoor (2)
Behut 10
Kulsea 5
Dadoopoor 34
Jughaibree
Booreeah 22
Bundole 12
(11) Tejlee
Moonda Majra 32
Dhamla 27
Kanjnoon 55
Pudour 27
Bun 32
Ludwa 35
Saharunpoor 38
Manikmow 30
Rutnakheri 30
Reeree 70
Bedrah 22
Tugetha 20
Jajwah 26
Kurpal 35
Pinkhuni 13
Sidhowlee 10
Kheree 17
Umbheta 15
Sehuswa 10
Newabas 27
Kunjowli 8
Rampoor 20
Seeied 52
Anutinow 68
Beera Khera 15
Dhakadar 37
Ringowli 57
Alba 62
Teekroli 60
Munowra 47
Gungali 17
Luknowtee 52
Zynpoor 65
Soorujpoor 52
Indree 60
Goodah 60
Piryarka 42
Khera 52
Beebeepoor 31
Dhurrua 35
KURNAL
Poojra 50
Berkheree 57
Mogul Majra 45
Newal 52
Thanna Bhuwn
Passuree 67
Manikpoor 52
Kheree Gudhoa 62
Khyl 70
Bhenswal 60
Mulhendi 37
Shamli 1
Mundait 65
Khandowli 37
Muzuffurnuggur
Kandla 25
Nulla 27
Kukripoor 32
Romalla 37
Painput
Soontee 35
Mokunpoor 15
Solana 17
Bujwarra 17
Sherpoor 7
Sunowli 5
Dukana 32
Joumana 32
Fazilpoor 22
Kuwalla 7
Ramnuggur 7
Bazeedpoor 12
Lohara 20
Barotz 22
Tetrondi 22
Powiss 12
Lowulpoor 35
Nugla 27
Busode 20
Deola 20
Meelhee 7
Muhrumpoor 4
Mooburikpoor 17
Binnapoor 2
Gunnowli 4
Kurhurree 0
Soneput
Jowalapoor 5
Hurdwar
Kunkhal 22
Bahadurabad 17
Santul Shah 11
Budheera 12
Roorkee 7
Punniala 15
Manglour 2
Liburheru 0
Muhmoodpoor 2
(2) Poor
Khairkera 5
Deobund 5
Nirgajne 0
Bela 0
Bopra 0
Yusufpoor 0
Togulpoor 2
Jowli 2
Kowal 5
Chitowra 0
Tuppoor 0
Khotowli
Lahora
Mulmudpoor 5
Suthereo 7
Jowalaghur 2
Sirdana 5
Nurnoor 1
Balsowna 10
Doonghur
Peeplee
Aderspoor 5
Bhola 2
MEERUT 2
Bhoorbural 22
Begumabad 10
Sekeree 5
Dohaee 0
Gokuna
Gazeeoodeen Nuggur 20
Arthulla 2
Karrera
Sucrowli 10
Suhulpoor 10
Duggurpoor 15
Bhurrapoor 2
Bughouli
Bulonli 20
Lonee
Betalu 10
Shahdera 18
Schmpoor 57
Jopdlak 50
Khurja
Cantonment Bazar 39.
DELHI

OOAB CANAL
DELHI CANAL
JUMNA RIVER
GANGES RIVER
THE PROPOSED CANAL OF THE HINDOON RIVER



REFERENCES

Irrigating Villages
Unirrigated Villages
Well Irrigating Villages
Kadir Villages

(Signed) T.E. Dempster Surgeon
1st Brigde Horse Artly.

True Copy
W. Bullock
Offg. Secy Mily. Board.

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country near Hansie. Continue along the Hansie branch and mark well the five last villages beyond Hissar, three of which irrigate from the Canal and two do not.

9th. Observe, that a high number in an unirrigated group would be considered a low or at least moderate number, if belonging to an irrigated one, and lastly, remember, that the average percentage, (as given in the General Summary) for the irrigated villages within the Delhie Territory is 53; while that for the unirrigated parts within the *same Territory* is only 11!

10th. The conclusion is irresistible, that some cause or causes connected with *this* Canal, or with its irrigation have, during late years, contributed in an extraordinary degree to the production of enlarged spleen. So far I trust, there can be no dispute.

Before quitting Plan No. 1, let attention be directed to the space included within the *blue* line, and which by an error in the sketch map, is placed somewhat too near Delhie. An examination of the numbers belonging to this circle of villages will demonstrate, that whatever the cause or causes of spleen disease may be, they *also* abound in this notoriously low marshy tract.

11th. Having thus noticed the principal features of Plan No. 1, I proceed to Plan No. 2, which exhibits a series of facts not less important, but of a very different character. I beg it may be borne in mind, that I was still ignorant of the nature of the country to be gone over, and continued to place myself entirely under the direction of the Canal Officers, as to the places selected for examination.

12. Let us commence near Delhie, and follow the route of the Committee upwards to the head of this Canal. First, I would direct attention to the high numbers belonging to the villages situated in the low "khadir" land on this side of Delhie, whether irrigated from the Canal or not. As we ascend the stream, we perceive, for the first time, that *full Canal irriyation,* even when conjoined with close proximity to the Canal, is compatible with a *very moderate amount of spleen disease.* This most important step in the investigation will be found to be further confirmed by the condition of some of the villages above Seharunpore.

13th. We have also a good opportunity in the southern division of this Canal, of comparing Canal with Well irrigation in parts very similarly situated in all other particulars; and we observe that while spleen disease is moderate in all, there is an average in favor of Well irrigation.

14th. Proceeding upwards, remark particularly the sudden change which takes place in the immediate neighbourhood of the Town of Shamlee,* how the numbers at once attain the maximum rates, and continue very high, specially in the villages near the Canal, until we come to the high land above Seharunpore, where the numbers almost as suddenly return to low rates and so continue up to the Canal's head.

15th. It will be further perceived, that the villages situated in the low "khadir" of the Ganges, Jumna and Hindoon Rivers often, but not uniformly, exhibit high numbers. Finally turn the eye to the long line of villages from Roorkhi to Meerut and from Meerut to the banks of the Hindoon; the whole of this tract of country is in a high state of cultivation; the lands are either altogether unirrigated or irrigated from Wells: the whole enjoys the most remarkable exemption from spleen disease.

16th. Having finished a rapid survey of the plans, it is now the proper time to enquire, if any remarkable local circumstances are common to all those tracts where spleen disease generally prevails, and especially what conditions we find common to the central division of the Dooab, and the Delhie branch of the Kurnaul Canal.

17th. The peculiar geographical features of the high land on the right bank of the Jumna have been fully explained in the body of the Report, and it is there shown how the banks of a Canal, originally constructed without any view to preserving the drainage of the country, have every where impeded or absolutely obstructed it. To obstruct the natural drainage of a country subject to copious periodical rains, and having a hot climate, is obviously to flood it in the most mischievous manner; all this literally happens in most parts of the country traversed by the branches of the Kurnaul Canal, but more especially between Kurnaul and Delhie, where also the low or "khadir" land bordering the Jumna, is every where saturated with excess of moisture.

18th. With a few isolated exceptions, the soil of the irrigated lands, lying on the right bank of the Jumna is generally stiff and retentive of water, and it is easy to conceive how Canal irrigation practised under such circumstances must aggravate all the evils of an obstructed drainage.

19th. The country on the left bank of the Jumna through which the Dooab Canal passes is of a very unequal character.

20th. The main features of the southern division excluding the "khadir" lands are perfect surface drainage and a light permeable fertile soil. The Canal irrigation is here carried on by "Rajbahas"

* It was agreed to exclude Shamlee from the Medical examinations, being a notoriously unhealthy town with *little* Canal irrigation.

or main water-courses which control the useless and pernicious waste of water. The country generally is in the highest state of cultivation; the irrigated fields coming close up to and surrounding the villages. We had the advantage of examining this tract immediately after heavy rain, and witnessed the completeness of the drainage and the absorbent nature of the soil.

21st. In the Northern Division, the Canal is conducted from the Hills over an inclined plane, being let down to the lower levels by successive masonry falls. The stream is here rapid and the water clear and limpid, except in the rainy season. The soil of the adjoining country is almost uniformly light and fertile, but the lands are neither fully irrigated nor highly cultivated. The inclination of the country, and rapid fall of the Canal secure complete general drainage. Where springs occur, the water is found very near the surface, but it seems to be every where in a state of quick transition. We observed a considerable excavation in the bed of the Canal where they were repairing the foundations of a Bridge, and yet it was quite free from a drop of water, although, in other parts, it is within a few feet of the surface.

22nd. The Southern and Northern Divisions of the Dooab Canal thus agree in having a perfect surface drainage and a light absorbent fertile soil.

23rd. The Central Division of this Canal has a very different character from the Northern and Southern portions just described. From circumstances connected with the levels of the country, and with a natural adjustment taking place in the Canal itself, the drainage of the country has here become as completely obstructed as in the worst portions of the Delhie Canal. After passing Mundait, a village near the notoriously unhealthy Town of Shamlee, the whole aspect of the Canal and adjoining country becomes suddenly and completely changed; the swampy belt of reeds and high grass which so commonly accompanies the Delhie Canal is here met with for the first time. "Jheels" and marshes, swarming with aquatic fowls, are seen on either side, and the villages close to the Canal are often surrounded with shallow stagnant pools. The soil too undergoes a decided change, being no longer light and friable but generally stiff and clayey. From Abba, there is less apparent swamp; but no decided improvement in the general aspect of the country takes place, until four or five miles to the north of Seharunpore.

24th. We have thus been able distinctly to trace two remarkable local conditions common to all tracts irrigated from the existing Canals where spleen disease prevails to a great extent, viz., obstructed surface drainage and a stiff retentive soil; the first of these conditions being more uniform and constant than the second. And on the other hand, we find these conditions generally absent whereever spleen disease is rare. This is another most important step in our enquiry.

25th. But the question of greatest importance still remains to be discussed, viz., how far do the facts of the case before us support the position, "that the amount of spleen disease found in any tract of country is a fair average measure of the amount and intensity of the malarious influences to which its inhabitants have been exposed !"

26th. Had this been susceptible of *direct* proof, this test would never have been required ; but I trust I shall be able to adduce such evidence of another kind as will amount to the strongest possible confirmation of the soundness of my position. It is no new doctrine of mine, that intermittent and remittent fevers are the usual antecedents to enlargement of the spleen, or that the remote cause of such fevers is malaria or marsh miasma. Both these opinions are alike based on general experience and observation. All of originality I can claim, is the practical application I have made of the well-known, and universally admitted connection between malarious fevers and organic disease of a certain viscus.

27th. It has been shown above that wherever Canal irrigation is practised in parts where the drainage has been seriously obstructed, there spleen disease is generally found to an extraordinary extent; that the same occurs in extensive marshy tracts ; in parts subject to annual inundations ; and usually, in the low moist "khadir" lands found near the margins of large Rivers. Now all will admit that these are precisely the situations in which we might expect to meet with intermittent and remittent fevers ; especially if the soil is at the same time stiff and retentive. The general prevalence of spleen disease in *these very localities*, and its comparative rareness in all others, having *an opposite character*, is, in the absence of more direct proof, the most striking verification of the doctrine, which it is possible to conceive.

28th. But we are not entirely without evidence of a more direct nature. The Tables appended to the Report exhibit the percentage of adults attacked with fever in three successive years, at each place visited. These numbers, if rightly understood, afford a very valuable description of testimony ; but as they are liable, without particular caution, to be misconceived or improperly applied, the following explanation of their value becomes necessary.

29th. In describing the manner in which these numbers were obtained, it was stated, that each adult examined was asked "if he had

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Note.—It was my original intention to collect and to procure analysis of the various soils of the parts visited, but unless such specimens had been selected with the greatest care, and the analysis conducted with the most scientific accuracy, it could only have served further to complicate an obscure and difficult subject. The great length of time which this would have occupied caused me to abandon the idea. This is less to be regretted, as all attempts to connect the production of malaria with certain chemical ingredients of the soil have hitherto entirely failed in the hands of the most scientific chemists of Europe.

had fever this year, last year or the year before last?" We had too much trouble in obtaining satisfactory replies on these simple points, further to perplex the people with more minute questionings. Some gave their answers carelessly, and others with an obvious design to mislead; yet, on the whole, my conviction is that they generally replied to the best of their recollection at the moment, and that the *general averages* present a fair approximation to the truth. It should, however, be particularly borne in mind, that if an individual had suffered from fever for three months in succession, or only for one day in each year, *one and the same record was entered in the note book,* and therefore, that the Tables only show the percentage of persons having had *yearly* seizures of fever, *but convey no idea of the frequency, duration, or severity of the particular attacks, suffered in each year.* It should also be remembered, that fevers may be very prevalent; but at the same time, mild and manageable in some seasons and situations; while at other places, or in other years, they may be obstinate and severe, but the numbers attacked not materially greater. Although, therefore, the tables claim only to give the numbers attacked in each year, and although it is certain that the prevalence of fever bears no *fixed* ratio to its severity, yet, when *large averages* are taken, it is unquestionably to be expected that where the greatest numbers are attacked, there also will the disease prove most severe and protracted.

30th. To apply all this to the case before us let us take from the general abstract of medical examinations, the three highest and three lowest average percentages of spleen disease, and observe what relation they bear to the percentage of persons having fever in three successive years, thus :—

	Percentage of enlarged Spleens.	*Percentage of Adults, having Fever in the years, viz.* 1844.	1845.	1846.
Highest.	59	63	54	31=148
	58	51	45	41=137
	49	51	49	40=140
Lowest.	11	32	28	11= 71
	8	37	31	20= 88
	3	32	30	13= 75

N. B.—I have rejected six per cent. of spleen disease, as being an average of too small a number; viz., of three small unirrigating villages near the head of the Dooab Canal.

31st. *Slight attacks* of malarious fevers are seldom followed by bad consequences; but beyond a certain point of severity, they may be expected often to leave their mark behind, and in native subjects, this will usually be in the form of enlargement of the spleen. We

have only then to suppose (which we are fully authorized to do), that where the greatest numbers were seized, the attacks were most severe and most recurring; that in the three first instances above given, the severity and obstinacy of the disease was often *above*, and in the three last instances often *below* the point at which organic disease arises, and we obtain another and most striking confirmation of the soundness of the theory of the spleen test.

32nd. Need I here repeat, what I have so distinctly stated in another place, viz., that I do not pretend that this test will indicate the presence of the remote causes of *all fevers*, or even of all *endemic diseases* of this class?

33rd. If I had detected but a few cases of spleen here and there and could only show a *trifling* excess of that disease in certain localities, I admit little dependence could have been placed on a test of this nature. But the facts before us are very different. The amount of spleen disease found in certain situations is prodigious, and the difference in this respect, in others, often in close proximity, and only differing in those conditions which all admit to be favorable to the production of malaria, is most wonderful.

34th. If the explanation I have given be rejected, I am utterly at a loss to conceive what other can be offered, to account for the singular phenomena exhibited in the accompanying plans.

35th. As for the facts, which rest alone on my professional testimony, I am under no concern, knowing well they can be verified at any time, by any competent person. From first to last, I kept steadily in view, that I could have no personal interest in any result, not strictly and substantially true; and I took so many precautions only to register such cases as admitted of no doubt, and moreover had the advantage of comparing two sets of observations made in two separate seasons, that I can afford securely to abide the result of any future enquiry; due allowance being made for any decided change in the character of the seasons.

36th. Again, if I had always found what I looked for, others might have suspected the accuracy of my observations. Nay, I might have had reason to suspect myself; but Major Baker knows that I was early obliged to confess how impossible it is, in any single instance, to pronounce a confident opinion, from a mere hasty inspection of the external features of a place, and that in some instances the result was the very opposite of what I expected.

37th. These exceptions, when they occurred, were a source of disappointment, but now that the whole results are before me, I see in this very uncertainty a confirmation of my general fidelity; not that such exceptions confirm the rule, but they show, that I make no pretension to that suspicious degree of accuracy which is incompatible with investigations of this kind.

38th. I confidently appeal to the great mass of facts, especially as they appear in *general averages*, in support of the principles on which I proceeded, although there is admitted uncertainty in particular instances. Does not the same kind of uncertainty pervade the whole field of medical enquiry? What higher verification of sound principles could I expect, than that which I have obtained?

39th. I freely confess, then, that I often met with results which, on a hasty inspection of a place, I did not expect. Some of these apparent exceptions admit of a reasonable explanation; but others I am unable to account for. It would be interesting, but would extend these notes to a very inconvenient length, were I to enter into a detail of all the cases alluded to. I am, however, persuaded that much which at present seems obscure could be cleared up by a minute examination at different periods of the year; for it must be borne in mind that the plan of our enquiry rendered it necessary that we should travel 1200 miles, inspect above 300 separate localities, and personally examine above 12,000 individuals in a period little exceeding three months; and that it was impossible to do more at each place than note those obvious conditions which are admitted on all hands to be most concerned in the production of malaria. We could see where the surface drainage was much obstructed; and the general levels of the country were known to the Canal Officers. We could mark the physical character of the upper soils; observe the nature of the crops; measure the wells; and estimate the amount of percolation from the Canal, &c., &c. But the nature of the *sub*-soils was usually a matter of conjecture; and those minute and partial differences of level, which *the eye cannot discern*, but which cause some places to remain dry, and others to be long kept in a state between dryness and moisture, necessarily passed unobserved. Rivers, or "nullas" confined within narrow channels, or altogether dry in the cold weather, but which overflow their banks during the rainy season, and flood the neighbouring country, must also have escaped our observation, unless our attention happened to be especially called to them by some one well acquainted with the locality. All this considered, it is not to be wondered at if some places which appeared to us unobjectionable might assume a very different character if seen during the rainy season, or if minutely investigated.

40th. I beg I may not be misunderstood as to the nature of these exceptions. I never met with much spleen disease in parts acknowledged to be generally healthy nor found that disease absent in others where fevers are known to be commonly endemic. But judging of unknown localities by their external features alone, I occasionally found organic disease prevailing where I expected none, or looked for it where it did not exist.

41st. Some of these cases are so strikingly illustrative both of the uncertainty of common indications and of the practical value of the

spleen test, that I shall relate a few of them, at the risk of being tedious.

42nd. We had been passing through a comparatively healthy portion of the Dooab or Saharunpore Canal, when the point came to be discussed whether or not Shamli should be included in our medical examinations. That town had been notorious for years past for its extreme unhealthiness; but its lands were only *partially* irrigated from the Canal. By including it, therefore, we ran the risk of throwing blame on Canal irrigation for disease, which, in this instance, obviously depended in a great measure, on other causes. For these reasons it was determined to exclude Shamli from our returns. I had not seen any map, and had no knowledge of the position of Shamli beyond a vague idea that we should pass it in a day or two. Next morning, I was conducted by Lieutenant Smith, of Engineers, to the village of Mundait (see plan No. 2,) the site of which appeared favorable, the whole of the surrounding lands perfectly dry, and the soil light and fertile. I remarked, "We ought to have a favorable result here." I then commenced the usual examinations, and to my extreme surprise found the test indicating the maximum of malaria. To add to my perplexity, the persons interrogated did not acknowledge any unusual amount of fever. I could not help concluding that the test had at last completely failed me. When the examination was finished, I confess I was not a little gratified to learn from Lieutenant Smith, that the notorious Shamli, although concealed from view by the neighbouring hedges, was only *half a mile* distant, and that the ground we were then on was annually submerged by the overflowing of the adjoining Shamli Nulla. In point of fact (as I afterwards learnt) we had just then entered upon an extensive unhealthy tract. A few miles further on, and the whole aspect of the Canal and country was suddenly and entirely altered; but at Mundait, this was not perceived. The true character of the locality was at once detected by the test *before a single visible sign appeared to indicate the change.*

43rd. The spleen test stood higher in my estimation than ever, the more so perhaps that I had doubted its veracity at the very time when its practical utility was most clearly exhibited.

44th. When residing with Major Baker at Roorkhi (the Head Quarters of the Ganges Canal Establishment), I was asked by that Officer to examine the non-irrigating village of Punniala (a few miles to the south of Roorkhi)and which he suspected would turn out badly. It had a large shallow tank on one side, viz., from S. E to S. W. On the west were rice fields and small shallow tanks. On the east a grove of fine mangoe trees, and about half a mile beyond in this direction, a considerable extent of low land, then dry, but wet and swampy in the rainy season. Few would hesitate to pronounce such a locality decidedly malarious. The test, however, only indicated a moderate

degree of malaria, and the inhabitants persisted in declaring that they were not much afflicted with fever. Inquiries afterwards made at Roorkhi fully corroborated this statement of the people. My conjecture is that the very *excess* of moisture in the rainy season and the belt of fine trees between the village and low swampy ground save this locality from mischief; but in whatever way it is accounted for, there is little doubt that the village of Punniala is not decidedly unhealthy.

45th. On our way to Hurdwar we stopped at Sunthul Shah (see plan No. 2,) a non-irrigating village, on a good and perfectly dry site. The upper soil was sandy, and not a *jheel* or pool of water visible in any direction. The village last examined, was tolerably healthy, and I expected this would turn out even better; but here again I was deceived, and surprised to find an unusually large amount of spleen disease, the inhabitants without a dissenting voice declaring that they were greatly afflicted with fever in the rainy season. After hearing Lieut. Yule's explanation, the mystery was completely solved. It appears that this village is built close to the right bank of the Putthee, a river or nulla with a narrow channel, which becomes so suddenly filled in the rains by several hill torrents that it overflows, and inundates the whole ground to the north of the village up to the walls of the houses. The soil too, although it has a stratum of sand deposited on its surface, is below very stiff clay, and where there are cart tracks, is cut up into the deepest and most rugged ruts.

46th. Judging from external features alone, who would hesitate to encamp an army near Mundait or Sunthul Shah? The mistake would hereafter be discovered to the cost of that army. By the spleen test, the real character of these localities was detected in a few minutes.

47th. The following circumstance first suggested to my mind the probable value of the test of organic disease.

48th. In the cold weather of 1843-44, I was directed by my Commanding Officer to report on the physical efficiency of the Europeans of the 1st Brigade Horse Artillery, who had suffered so severely from the Kurnaul fever during the three or four previous months. On this occasion, I made a minute and careful exploration of the abdominal region of every man in the corps, and was surprised to find so great a number of them laboring under some degree of chronic enlargement of the liver and spleen, which would not otherwise have attracted attention. The women and children were even in a worse state; but in them the organ affected was almost uniformly the spleen. Suppose I had made this examination without any knowledge of the previous history of the detachment, could I have hesitated in pronouncing that they were then in, or had recently been removed from, an unhealthy locality? or that the diseases from which they had

chiefly suffered, were intermittent and remittent fevers? On this hint I afterwards acted, and when I found a whole native community afflicted with organic disease of the spleen, could I hesitate in coming to the same conclusions? The converse of the proposition is not so obvious, viz., that where the inhabitants are free from organic disease, the locality is healthy, for it is possible they may have suffered from causes unconnected with malaria, and from diseases which leave no such marks behind.

49th. Our reasons for adopting such a test as the one above described, instead of the more direct and obvious methods of calling for the sick at each place, comparing their number with that of the healthy population, &c., &c., have already been explained in the body of the report and in Appendix B. But for the benefit of European readers it will be necessary to advert more particularly to the causes which rendered the ordinary modes of procedure impossible in the present case.

First.—We were sent to investigate the nature and causes of a disease, the force of which had *passed by* before the Commitee commenced its labors, and of which not a single authentic record remained among the agricultural population, except in the effects it might have left on the persons of those who had been subjected to its influence.

Second.—At the time the Canal enquiry was ordered, there existed two parties violently opposed to each other, and holding entirely different opinions as to the nature and causes of the sickness which had prevailed along the banks of the Canal and other portions of the North-Western Provinces; one contending that the Canal was the sole cause of the disease—the other as resolutely maintaining that it was a pure epidemic, with which the Canal had nothing to do, even as an accessary or aggravating cause. It was highly necessary that the members of the Committee should avoid all suspicion of being the partisans of either of these parties; and we consequently refrained from soliciting or recording the opinions and impressions of the natives as to the connection of the sickness with Canal irrigation, for if our object had been to defend preconceived opinions we could have so shaped our questions, and so intimated our wishes, as to have obtained any amount of native opinions on *either side.* All such evidence, we knew, would have been rejected as uncertain and suspicious by both parties.

Third.—If we had been dealing with a present instead of a past disease, the following obstacles would have opposed themselves to any of the usual modes of proceeding which would have followed in Europe. The natives of these provinces, especially if they have had little intercourse with Europeans, entertain the most absurd notions of our medical science: they either expect from it cures literally miraculous, or they reject it altogether as hurtful. They are moreover capable of believing the grossest absurdities as to our motives for interfering with mat-

ters concerning the public health. The history of vaccination in India will well illustrate these points of the native character.

50th. Had we attempted to compare the relative salubrity of different places by calling for the sick at each, the caprice of the moment, an extravagant hope of benefit, or equally extravagant dread of evil, would have determined the conduct of the people towards us, and it would have been impossible to foretell, in any particular instance, whether they would have produced their sick with eagerness, or concealed them with obstinacy. If we had applied to the civil power to aid us in the production of the sick, we should have found ourselves in even a worse position. Our visit would have been immediately converted by the native officials into an instrument of extortion; the wildest falsehoods would have been propagated as to our designs; the sick would have *paid* to be exempted from examinations; and we should have been more completely deceived than ever. To collect *all* the sick at each place, was then, I maintain, impossible by any means at our disposal. But supposing this effected, viz., that we not only got together all the sick at each town or village, but did so in a very short time (a most important point) what should we have gained, unless we had at the same time the means of comparing their number with that of the healthy? and how was this possible in a country where the population of the towns and villages is either altogether unknown or matter of vague conjecture?

51st. Any other method than that which we pursued, might indeed have served to prolong a party controversy, but never could have elicited the truth.

52nd. Scanty as the means at our disposal were, they have notwithstanding served us admirably, and have led to a degree of certainty in the results which could hardly have been anticipated when we set out.

53rd. I have one more observation to make regarding the true value to be attached to the facts we have collected, and the propriety of drawing from them *general conclusions* as to the effects of Canal irrigation. Our observations were extensive enough as regards *space*, but limited as to *time*. They were made after a series of notoriously unhealthy years, and confined to a period hardly exceeding three months. They appear satisfactorily to establish the fact that certain localities suffered more severely in those *sickly seasons;* but what would be the relative salubrity of the irrigated and unirrigated parts under *ordinary and more favorable circumstances,* is only matter of conjecture.

54th. It would contribute greatly to the settlement of this important question, as well as to medical science generally, if the same ground were gone over again in the same manner after a series of

healthy years, and when the purely local causes of disease are uncomplicated with any powerful and extensive epidemic influence.

55th. If the facts exhibited in the accompanying plans be received as correct, and the arguments deduced from them be admitted as sound, the whole will be found to involve a principle capable of the most important and extensive practical application, and which I now proceed to explain as a corollary to the other results of the Canal Committee.

56th. It is now generally admitted, and has been most fully confirmed by our recent observations, that, although certain general principles are unquestionably true and deserving of the most careful consideration, there are no *infallible marks*, by which we can at once distinguish between a healthy and unhealthy locality. It is much to be regretted that the hasty and confident predictions of medical men, too often falsified by the result, have tended to bring their judgment on such matters into disrepute, and have led both Government and Military Commanders often to disregard some of the best established general truths, to the incalculable loss of life and property.

57th. It is the acknowledged difficulty, as well as the great importance, of being able to decide at once in particular instances, that constitutes the value of some other corroborative test, which can be easily applied wherever there are inhabitants. The following rules, carefully applied, will, I feel confident, never fail to give important information, in so far as disease depends on local malarious influences.

First.—However healthy a locality may appear in other respects, if its native inhabitants are generally afflicted with organic disease of the spleen, *there*, beyond all doubt, does much malaria exist, and there also, will European and native troops suffer, especially in all unhealthy years or seasons.

Second.—If a district has the ordinary marks of a malarious locality, and its native inhabitants are notwithstanding found free from disease of the spleen, the presumption is, that malaria is not present in any intensity; but strangers may suffer, where permanent residents escape.

Third.—Again, if it has the usual characters of a healthy locality, and its native inhabitants are entirely or almost free from spleen disease, it may be confidently selected as a good position for European and native troops.

58th. I do not for a moment forget, that there are other efficient causes of human disease, besides malaria, and that to some of these the European soldier is especially obnoxious—such as excessive heat; great and sudden alternations of temperature; epidemic influences of various kinds, &c. &c. Of the existence of such causes, the spleen

test cannot be expected to give intimation. But all will admit that these causes of disease are enhanced by the presence of malaria, and that it is in malarious situations where epidemic fevers often rage in India with the greatest virulence. The facts recorded in the Committee's Report strikingly illustrate this last position.

59th. It has been suggested that no new position for troops should be taken up in this country, before interrogating the natives as to the prevalence of disease. But my experience teaches me that no reliance can be placed, *in any single instance*, on what the people say on such a subject. If the object of enquiry is suspected, and they dread the presence of troops, they will not hesitate in giving a false report. If they fear (as they sometimes do) that they are to be physicked by order of Government, they will protest "they never were sick in their lives." If in doubt as to our motives, they too often think their safest course is in falsehood. The testimony of the native inhabitants, if given in a *truthful* manner, and taken in conjunction with the test of organic disease, may no doubt prove most valuable in many cases.

60th. It seldom happens in India, that troops are encamped in situations altogether destitute of inhabitants; but should such a case occur, the following directions may be found useful to Officers in the selection of ground, especially if it is intended to be occupied during the rainy season. The rules are drawn entirely from observations made during the recent inquiry. I believe they include all the principal conditions, but I do not particularly notice those of which we have seen no examples.

61st. Good *general drainage*, not of a camp or cantonment only, but of the whole immediate neighbourhood, is the alpha and omega of the code. Without this, few localities can really be healthy in these provinces. The stiffer and more retentive the soil, the more important does good drainage become.

62nd. The following are the more obvious marks of a healthy situation. Ground dry and generally free from heavy grass or bush jungle. Drainage of the surrounding country good. Soil light, or not very stiff and clayey, it may also be fertile and bearing fine crops. No extensive shallow *jheels* with shelving *poachy** margins. Water of wells good and potable. Absence of rivers or *nullahs* liable to overflow their banks during the rainy season. The state of the roads furnishes an excellent index to the nature of the soil and drainage. In good localities they are dry, dusty or sandy, but never extensively cut up into *deep rugged ruts*. Tanks, if they have steep sides, and are kept full of water all the year through, appear

* *Poachy.*—An expressive word used by McCullock to signify that state of the surface when it easily *receives* and *retains* the foot-marks of animals, &c. &c.

harmless. Fine trees, not so closely planted as to impede ventilation, are desirable. Such a locality will generally have a gentle inclination in one, or several directions, often invisible to the unassisted eye, but sufficient for good drainage.

63rd. I need say nothing here of palpable swamps and marshes, or extensive dense Indian jungles : all know such situations are to be avoided if possible. But the following are not so obvious or generally known.

64th. The belt of moist low and often fertile land, found alternately on one or other side of large rivers in these provinces, is generally to be avoided as unhealthy. There are, however, some notable exceptions to this rule. Villages built on the verge of the high land overhanging a low unhealthy *khadir* tract are sometimes in as bad a position as if situated in the low land. To this rule also there are exceptions. Isolated elevations in low moist tracts are often the worst positions which can be chosen.

65th. All cup-like depressions, even if so gentle as to appear to the eye a perfect flat, are to be avoided. Such localities may be free from *jheels*, or stagnant water, may be cultivated throughout, and bearing fine crops ; yet if the soil be stiff and retentive, and the lands irrigated, they may turn out more unhealthy than the worst apparent marshes.

66th. In some parts, and especially in the neighbourhood of the Nujufghur *jheels*, we found disease to bear an almost exact ratio to the nearness of the water to the surface ; but in other situations the people were perfectly healthy, although the water in the wells was only a few feet from it.

67th. The subject of the local and remediable causes of disease is attracting great attention at home, where so much has already been done in this department; but in this country, where such measures are far more urgently required, very little has yet been attempted. The evils of impeded drainage have long been fully appreciated in Europe. What some of its effects are in India, the accompanying plans will sufficiently demonstrate. The recent Canal Committee is perhaps the first methodical attempt ever made in this country to ascertain the local causes of disease, in order that they may be remedied; and although, I hope, good will result, as far as the improved construction of irrigating canals is concerned, I need not say how much remains every where to be done.

68th. It is an error to say that all the mischief we witness in India, is inseparably connected with the climate ; for healthy and unhealthy localities are everywhere found in close proximity. It is equally unreasonable to assert that all these local sources of disease are beyond remedy. Some are so perhaps, and when known, (and the

sooner they are known the better.) can only be avoided; but that the majority are capable of being removed, or greatly diminished, all experience tends to establish.

69th. I believe that profitable irrigation and improved drainage, instead of being incompatible, may very often be made to assist and promote each other. Major Dixon's measures seem to be a valuable example of this, and some similar system might be followed with advantage in various parts of India. In the protected Sikh States, for instance, the people are in the habit of damming up the streams which traverse the country, flooding their own lands with a mischievous excess of water, and thus depriving their neighbours below of their proper share. How much good would a proper and fair distribution of water do, both for the agriculture and salubrity of such a country?

70th. The whole of this subject is of the most vital importance both to the Government and people of British India.

71st. All men admit that "prevention of human disease is better than cure," but it is neither so obvious nor so generally known, though equally true, that it is not only better in itself, but more certainly attained and more efficaciously applied. The progress of medicine, as a curative art, has been slow and uncertain, and can claim no comparison with the improvements which have taken place within the last 150 years, in the *far better art* of preserving health. For one life now saved by physic, 100 might be preserved from fatal disease, by improved drainage, ventilation, cleanliness, &c. &c.

72nd. The present attempt to confer on the natives of India the benefits of European medical science is worthy of a humane and liberal Government. Yet if its success were to exceed the expectations even of the most sanguine, if every native town had its Hospital and Dispensary conducted on European principles, every village its educated practitioner, and all classes eager to resort to them for medical aid, the advantage to the health and well being of the mass of the people, would not be a tithe of what would result from general and well-directed measures for removing or alleviating the local causes of disease.

(Signed) T. E. DEMPSTER.

Loodianah, 1st August, 1847.

P. S.—Several medical men having found difficulty in clearly comprehending how an irrigating canal comes to obstruct the drainage of the country through which it passes, I give the following explanation, as being more easily understood by persons who have not turned their attention to such subjects, than the one alluded to in the report.

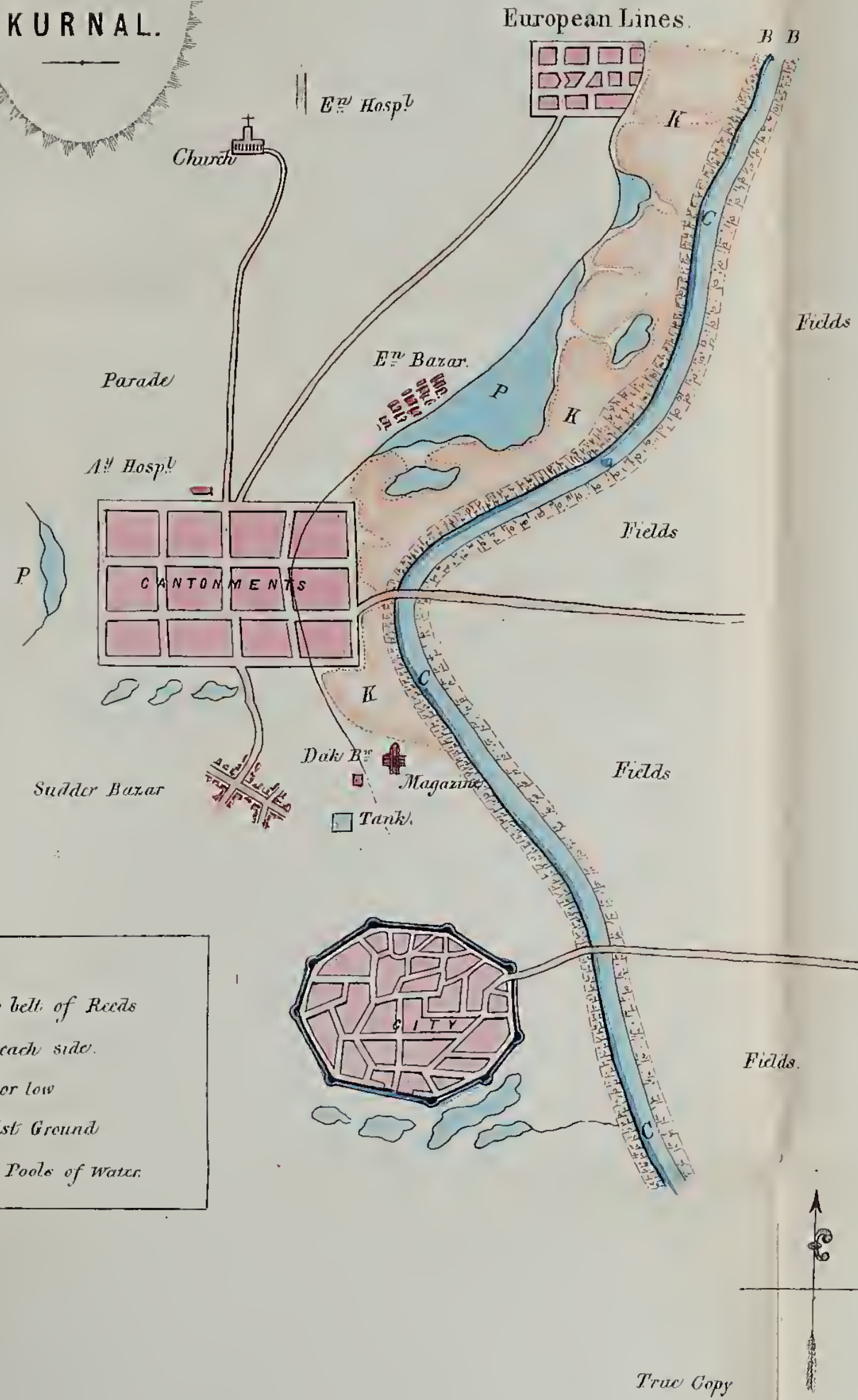
The west of Jumna canal was a work originally constructed by the Moosulman Government of Delhie, and only re-opened by us. The native Engineer, instead of taking the levels of the country, simply observed what was the natural course of the drainage water; and finding a considerable water channel running nearly in the direction required, he put his canal into it, following its most minute and tortuous windings. He was thus able at a small expense of engineering science to construct a canal, which he was sure would flow in the proper direction. Now, if we thus occupy the principal drainage channel of a country with an artificial canal, then introduce so much water, as will bring its level up to that of the lands through which it passes; a lower level will not do for irrigation; and lastly, add banks higher still; it is obvious, that no more drainage water can flow off in this direction; and, if no other efficient drainage channel exist, it is equally obvious that during and after the periodical rains, such lands must be flooded in the manner most prejudicial to health, that is, be long kept in the mid condition between moisture and dryness.

The annexed sketch of Kurnaul will serve to elucidate this point. In former days the drainage water of this part of the country was carried off by a natural water course, *now occupied by the canal.* For years after the canal was re-opened, the level of the water at this point was lower than that of the low *khadir* land lying between the canal and cantonments, and so long as this was the case, the canal still served the purpose of a drainage channel. But when a large additional supply of water was brought down and the level permanently raised to that of the fields on the east, (now irrigated,) the water from the high land of the cantonment found its way as usual into the low *khadir* ground, *but could get no further.* The canal, instead of serving as a drain, acted in the opposite manner; for its water freely percolated the banks and kept the whole of the low land saturated with moisture even in the driest seasons of the year.

The chain of *jheels* at the back of the city, formerly drained itself into the canal channel; now, a constant stream of water flows *from* the canal *into* those *jheels.* This fact aptly illustrates the whole matter.

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PLAN of KURNAL.



C. Canal.

B. Swampy belt of Reeds on each side.

K. Khadir or low Moist Ground

P. Jheel or Pools of Water.

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